890GTR

Battery Inverter

HA502996 Issue 1
Product Manual

aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

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890GTR Inverter Product Manual

HA502996 Issue 01

Software Version: 5.3

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Chapter 1 Safety

Please read these important Safety notes before performing maintenance or operating this equipment.

CAUTION

CAUTION notes in the manual warn of danger
To equipment

WARNING

WARNING notes in the manual warn of danger to personnel

This section contains the following parts:

- Requirements
- Product Warnings and Symbols
- Hazards
- Safety
- Application Risks
- Parker Required Personal Protection Equipment (PPE)

Safety Information

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions for all 890GTR models that shall be followed during installation and maintenance of the inverter.

Requirements

IMPORTANT **Please read this information BEFORE installing the equipment.**

Intended Users

This manual is to be made available to all persons who are required to configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, and to enable the user to obtain maximum benefit from the equipment.

Application Area

The equipment described is intended for use as power conversion in an energy storage system.

Personnel

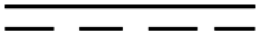
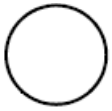
Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

Training

Qualified personnel must be trained in Safety-Related Work Practices, Job Hazard Analysis, First Aid and CPR, Arc Flash Hazards, and PPE Requirements (both classroom and on-the-job training are required in accordance with NFPA 70E requirements).
Retraining is required in intervals not to exceed three years.

Safety Information

Product Warnings and Symbols

Caution Risk of electric shock	**Caution** Refer to documentation	**Earth/Ground** Protective Conductor Terminal
 **Direct Current Supply**	**Alternating Current Supply**	**Phase Symbol**
ON Symbol	 **OFF Symbol**	

WARNING: The 890GTR is not provided with a GFDI device. This inverter must be used with an external GFDI device as required by the Article 690 of the National Electrical Code for the Installation location.

Safety Information

Hazards

DANGER! – Ignoring the following may result in injury

1. This equipment can endanger life by exposure to high voltages.
2. The equipment must be permanently earthed due to the high earth leakage current, and the supplies and loads must be connected to an appropriate safety earth.
3. Ensure all incoming supplies are isolated before working on the equipment. Be aware that there may be more than one supply connection to the inverter.
4. There may still be dangerous voltages present at power terminals (battery inputs and DC bus) when the inverter is stopped.
5. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product.
6. Under normal circumstances the AC and DC Bus should discharge within 10 minutes. Use a meter capable of measuring up to 1000 VDC & 600 VAC RMS to confirm that less than 50V is present on the DC BUS and between all power terminals and earth before working on or near the DC Bus.
7. Unless otherwise stated, this product must NOT be dismantled. In the event of a fault the component must be returned.

Safety Information

WARNING! – Ignoring the following may result in injury or damage to equipment

Safety

Where there is conflict between EMC and Safety requirements, personnel safety shall always take precedence.

- Never perform high voltage resistance checks on the wiring without first disconnecting the inverter from the circuit being tested.
- Whilst ensuring ventilation is sufficient, provide guarding and /or additional safety systems to prevent injury or damage to equipment.
- When replacing a component in an application and before returning to use, it is essential that all user defined parameters for the product's operation are correctly installed.
- All control and signal terminals are SELV; that is, protected by double insulation. Ensure all external wiring is rated for the highest system voltage.
- All exposed metalwork in the inverter is protected by basic insulation and bonded to a safety earth.
- Residual-current devices (RCDs) are not recommended for use with this product; but where their use is mandatory, only Type B RCDs should be used.

EMC

- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
- This equipment contains electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling, installing and servicing this product.
- This is a product of the restricted sales distribution class according to IEC 61800-3. It is designated as "professional equipment" as defined in EN61000-3-2. Permission of the supply authority shall be obtained before connection to the low voltage supply.

Safety Information

CAUTION!

Application Risks

- The specifications, processes and circuitry described herein are for guidance only and may need to be adapted to the user's specific application. We cannot guarantee the suitability of the equipment described in this Manual for individual applications.

Risk Assessment

Under fault conditions, power loss or unintended operating conditions, the inverter may not operate as intended. In particular:

Stored energy might not discharge to safe levels as quickly as suggested and can still be present even though the inverter appears to be switched off.

An inverter is a component within a system that may influence its operation or effects under a fault condition. Consideration must be given to:

- Stored energy
- Supply disconnects
- Sequencing logic
- Unintended operation

Safety Information

WARNING! – Ignoring the following may result in serious injury or damage to equipment

OSHA Electric Power Generation, transmission, and distribution safety standards (29 CFR 1910.269) consideration:

Workers may be exposed to arc flash hazards, electric shocks, and burns that can cause injury and death when making battery or grid connections. Do not work on connections to the battery container or the grid without proper safety considerations.

Safe work practices as proscribed in OSHA's Electric Power Generation, Transmission and Distribution Standard must be implemented and observed. Workers must complete worker training requirements of OSHA's Electric Power Generation, Transmission and Distribution Standard, 29 CFR 1910.269.

Dangerous electrical potentials which can result in electrocution and arc flash hazards are present while the battery container is connected. Workers must pay attention to both battery power conductors and overhead power lines. While fatal electrocution is the main hazard, other hazards include using tools and equipment that can contact power lines.

- Look for overhead power lines and buried power line indicators.
- Stay at least 10 feet away from overhead power lines and assume they are energized.
- De-energize and ground lines when working near them.
- Use non-conductive wood or fiberglass ladders when working near power lines.

Safety Information

WARNING! – Ignoring the following may result in serious injury or damage to equipment

Parker Required Personal Protection Equipment (PPE)

The following list is the minimum PPE requirements in accordance with NFPA 70E Article 130.7. When working within the Restricted Approach Boundary, the worker shall wear PPE in accordance with Article 130.4. When working within the Arc Flash Boundary, the worker shall wear PPE in accordance with Article 130.5. All parts of the body inside the Arc Flash Boundary shall be protected. Any person who will be required to use PPE will be required to complete training on the proper use of PPE. NFPA 70E Article 320.3(2) prohibits the wear of conductive objects and jewellery.

Table 1-1 Required PPE Optimum Specifications for HRC2 (8 cal/cm^2)

ITEM	RATING	NOTE
Hard Hat	Type 1, Class E	Must be nonconductive – **ANSI/ISEA Z89.1-2009**
Face Shield	10 cal/cm^2	ASTM F 2178-08
Safety Glasses	ANSI Z87.1-2010	Must be rated for Arc Flash
Balaclava	10.5 cal/cm^2	When working within the Restricted Approach Boundary or the Arc Flash Boundary **- ASTM F 1506-10a**
Hearing Protection	22 dB (A)	Must be Ear Canal Inserts - **OSHA 1910.95**
Undergarments	Natural Fibers	Meltable fibers such as acetate, nylon, polyester, polypropylene and spandex are not permitted
Shirt*	10.5 cal/cm^2	Daily wear - ASTM F 1506-10a
Pants**	10.5 cal/cm^2	Daily wear - ASTM F 1506-10a
Coveralls***	12.2 cal/cm^2	When working within the Restricted Approach Boundary or the Arc Flash Boundary **- ASTM F 1506-10a**
Rubber Insulating Gloves	Class 0	When Insulated Gloves are required by task **- ASTM D 120-09**

Safety Information

ITEM	RATING	NOTE
Leather Protectors	ASTM F 496-06	When Insulated Gloves are required by task (Minimum thickness .03in, unlined, ATPV value > 10 cal/cm^2)
Cotton Liners	Cotton	When Insulated Gloves are required by task (optional)
Steel Toe Boots	Heavy-duty Leather	Daily wear - ASTF 2413-05 (must be non-conductive) NO ESD
Outer Layers		Garments worn as outer layers over arc-rated clothing must also be made from arc-rated material (Use as Required)
Tools	1000V-Rated	When work on live circuits (>50V) is required by task - **ASTM F 1505**

***If a shirt is worn as a top layer, it must be rated at 10.5 cal/cm^2. If it is worn under coveralls rated at 12.2 cal/cm^2, it may be natural fibers and may be short-sleeved.

****If pants are worn as a top layer, they must be rated at 10.5 cal/cm^2. If they are worn under coveralls rated at 12.2 cal/cm^2, they may be natural fibers.

*****Coveralls are the preferred method of protection.

For more information please see **Chapter 7 PPE**

Safety Information

WARNING! – Ignoring the following may result in serious injury or damage to equipment Limited Approach Boundary, Restricted Approach Boundary, Prohibited Approach Boundary

Approach Boundaries to Exposed energized Conductors/Parts for qualified employees (NFPA 70E Table 12-1):

- For troubleshooting and testing purposes only, qualified persons using proper test equipment and personal protective equipment must adhere to the boundaries shown below. For adjusting, tightening, calibrating or other work, the circuits must be de-energized, or employees must use voltage-rated gloves and voltage-rated insulated tools.
- For Low Voltage Troubleshooting and Testing only (under 480 volts), a qualified person may penetrate the prohibited approach boundary with instrument probes, leads, CT's, etc. The qualified person must wear Class 00 (500 volt-rated) gloves.
- Supervisors and employees must ensure that an unqualified person can never come closer to any energized line or part than the Limited Approach Boundaries

Table 1-2 Approach Boundaries by Voltage

Approach Boundary[1,2]	**< 50 VAC < 100 VDC**	**50-300 VAC 100-300 VDC**	**301-750 VAC 301-1k VDC**	**1.1-5 kVDC**	**751-15 kVAC 5-15 kVDC**
Limited Approach (Exposed movable conductors)	Not Specified	10' – 0"	10' – 0"	10' – 0"	10' – 0"
Limited Approach (Exposed fixed circuit parts)	Not Specified	3' – 6"	3' – 6"	5' – 0"	5' – 0"
Restricted Approach (Shock protection Required + PPE)	Not Specified	Avoid Contact	1' – 0"	1' – 5"	2' – 2"
Prohibited Approach (Equivalent to direct contact)	Not Specified	Avoid Contact	0' – 1"	0' – 4"	0' – 7"

[1] Boundary indicates the minimum working distance of the worker's face and chest

[2] Limited Approach Boundary is 0" with all Access Doors and Panels closed and secured.

Safety Information

WARNING
ARC FLASH AND SHOCK HAZARD
This unit is powered by batteries
Do not work on this equipment
Without locking out all battery sources

Figure 1-1 Battery Inverter Warning Placard

A variety of battery types may be used in battery enclosures to supply a DC input to the Battery Inverter Enclosure. Each manufacturer can provide specific Cautions and Warnings for work on and around batteries and for battery storage which should be observed.

Chapter 2 Getting Started

A few things you should know about this manual.

- How the Manual is organized
- Initial Steps
- Abbreviations / Definitions

About this Manual

This manual is intended for use by service and maintenance personnel. It assumes reasonable levels of understanding in the disciplines required to service and maintain this equipment.

Note ***Please read all Safety information before proceeding with the service, maintenance and operation of this unit.***

It is important that you pass this manual on to any new user of this unit.

How the Manual is organized

This manual is organized into chapters, indicated by the numbering on the edge of each page.

The manual is focused on servicing and maintaining the Inverter Enclosure. For more detailed information on specific components inside the inverter, refer to the relevant manufacturer's product manual.

Initial Steps

Use the manual to help you plan the following:

Service and Maintenance

Know your requirements:

- Training requirements
- OSHA Safety conformance
- Compliance with Arc Flash requirements

Contact Details

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www.parker.com/egt

Abbreviations / Definitions

AC	Alternating Current
ANSI	American National Standards Institute
APT	Active Power Tracking
AVR	Automatic Voltage Regulation
Converter	A device that converts one type of energy to another (AC-AC, AC-DC, DC-DC, or DC-AC)
DC	Direct Current
Drive	a generic term for an Adjustable Speed Drive (ASD) or Variable Speed Drive (VSD)
EPO	Emergency Power Off
FR	Flame Resistant
HRC	Hazard Risk Category
HVRT	High Voltage Ride Through
HMI	Human Machine Interface
HOL	High Operating Limit
IGBT	Insulated Gate Bipolar Transistor
Inverter	A converter that changes DC current into AC current
LOL	Low Operating Limit
LOTO	Lock Out Tag Out
LVRT	Low Voltage Ride Through
MPPT	Maximum Power Point Tracking
MPT	Maximum Power Tracking
MVA	Mega-Volt Amperes (Apparent Power)
MW	Megawatts (Real Power)
PCM	Parallel Control Module
PCS	Power Conversion Station (Inverter Transformer Pad)
PF	Power Factor
Plant	Power Plant
PLC	Programmable Logic Controller
PPC	Power Plant Controller
PPE	Personal Protection Equipment
P/S	Power Supply
PV	Photovoltaic
RPI	Requested Packet Interval
SCADA	Supervisory Control and Data Acquisition
SP	Setpoint
System	Power Plant Control System
VAR	Volt Ampere Reactive (Reactive Power)
XML	Extensible Markup Language

Product Overview

Control Features

The inverter is fully a featured grid/battery interface when controlled using the Modbus TCP interface. Customized programming can be accomplished via either the local USB or LAN interface.

General	Output Frequency	Nominal 50 or 60 Hz with adjustable trip points.
	Switching Frequency	Minimum 2kHz. Nominal 4kHz (optimal for output filter) Maximum 5kHz.
	Control Modes	Real (Id) and reactive (Iq) current control Power (KW) and VAR (KVAR) control
	Support functions	Frequency support Low Voltage Ride through with KVAR injection
	Diagnostics	Full diagnostic and monitoring facilities
Protection	Trip Conditions	Output short line to line Overcurrent > 220% HD current Heat sink over temperature Filter inductor over temperature DC bus overvoltage and under voltage AC grid overvoltage AC grid under voltage and LVRT AC grid over frequency and under frequency
	Current Limit	IxT foldback Heat sink temperature foldback
	Rating	100% continuous (128 Arms) 150% for 60 seconds (192 Arms)
Inputs/Outputs	Analog Inputs	2 configurable inputs; voltage or current
	Digital Inputs	3 configurable 24V dc inputs

Getting Started

References:

DSE Lite Configuration Tool Software Manual—HA471486U001

Overview:

The 890GTR is based on the AC890 control platform utilizing the DSE (Drive System Explorer) Configuration Tool. DSE Lite is software that can be loaded onto a compatible PC. The PC can then be connected to the 890GTR via a micro-USB cable. Once connected, the PC provides a portal into the 890GTR allowing monitoring and control of critical variables and modification to the application layer of the inverter. The application layer, known as the “Configuration”, allows customization of the 890GTR’s programming using a graphical block diagram language.

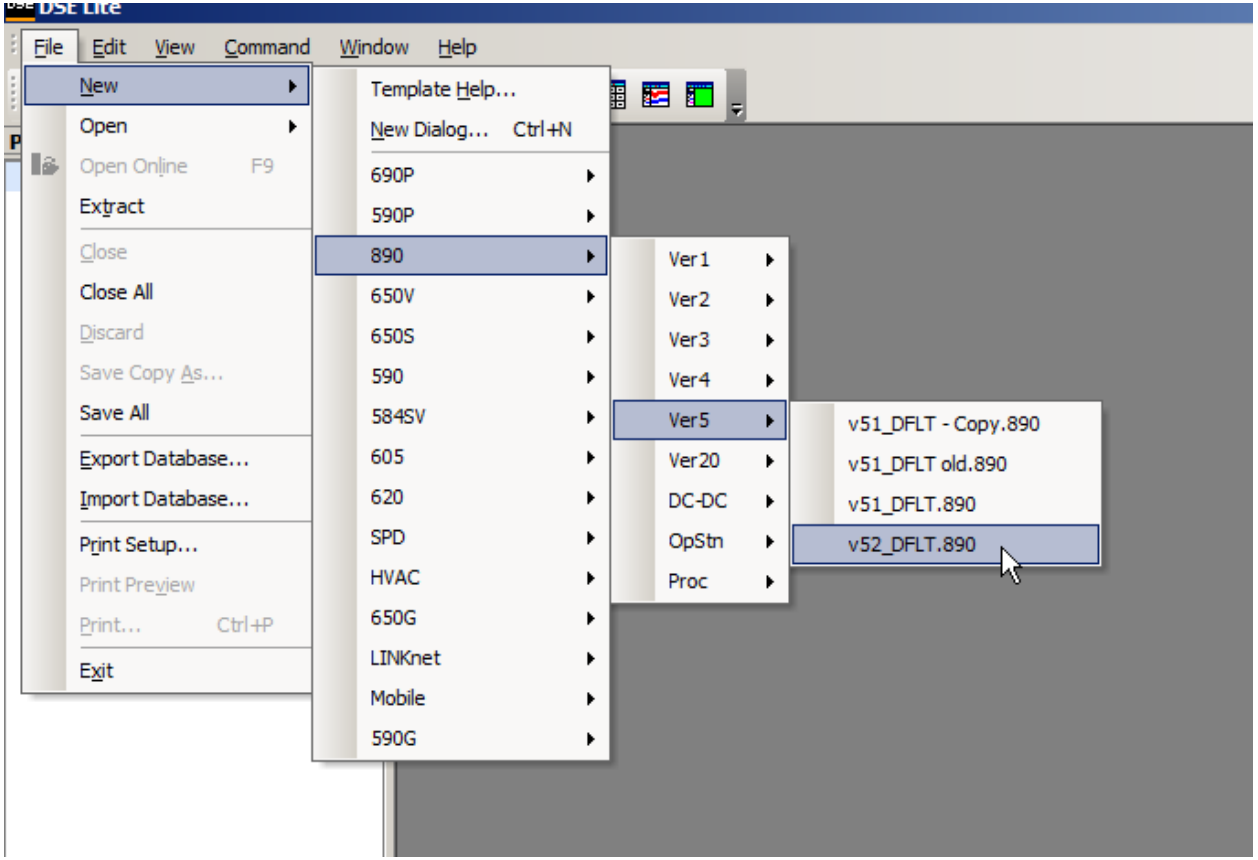
Firmware, not to be confused with the configuration, contains operating system of the 890GTR. Firmware cannot be modified by the user, but may need to be updated from time to time to accommodate enhancements. The 890GTR uses Version 5 firmware which has been optimized for grid ties applications.

Connecting with DSE Lite:

1. Load DSE Lite onto compatible PC (refer to DSE Lite manual).
2. Connect computer to 890GTR using mini-USB communication cable.
3. Launch DSE Lite.
4. Ensure 890GTR has control power present.
5. Establish connection to 890GTR by clicking refresh (refer to DSE Lite manual).

Creating a configuration

A configuration can be created using DSE Lite. Several templates are available to jump start the process and templates are model and firmware specific. Simply click on “File→New→890→Ver5→v5x_DFLT.890” to load the appropriate template. The template will appear as a tab in DSE Lite. Once the configuration has been created it can be saved under a new name using the “save copy as” under the File menu.



Modifying a configuration:

When configuration is open in DSE Lite, modifications can be made using the DSE Lite editor. Refer to DSE Lite manual for details.

Loading a configuration:

When a configuration is ready it should be saved to disk before downloading to the inverter. Below are the basic steps to load a configuration into the inverter:

1. Save configuration to disk (File→Save).
2. Ensure inverter is not running (synchronized to grid).
3. Ensure DSE Lite is connected and communicating to inverter (Command→Refresh Partial).
4. Install configuration to inverter (Command→Install)

Setting IP address (see Chapter 8 for additional details)

Method 1 (Manual):

1. Connect using DSE Lite.
2. Load Configuration into DSE Lite editor either by “Extracting” configuration from inverter or by loading a configuration file.
3. Navigate to page 5 of configuration where “Ethernet block” is located.
4. Double click on “Ethernet block” to open dialog/parameter box.
5. Enter in correct IP address.
6. Save updated configuration to disk if desired.
7. Install updated configuration into inverter.

Method 2 (BOOT P):

1. When an installed configuration has an IP address set to 0.0.0.0, then the inverter will request an IP address from the Ethernet server.
2. Refer to DSE Lite manual for details.

Updating firmware

Occasionally it may be necessary to update the 890GTR firmware to enable new functions or address specific requirements. This can also be done through DSE Lite using the following procedure:

1. Copy new firmware file into the following directory on a computer loaded with DSE Lite configuration tool: C:\SSD_link\firmware\
2. Connect to inverter using DSE Lite.
3. Ensure inverter is not running.
4. Click on: Command→Install Firmware
5. Confirm Install Firmware by clicking on message box.
6. Select firmware using drop down list.
7. Begin firmware load by clicking on “Install”.

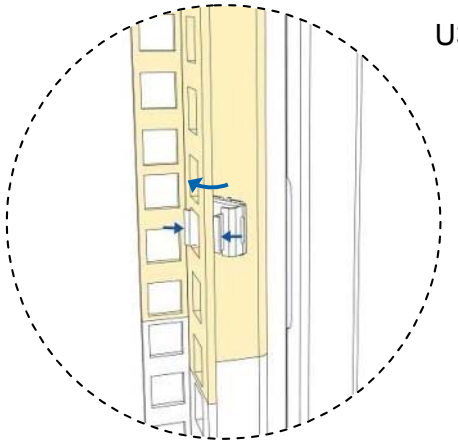
Chapter 3 Installation

This chapter describes the mechanical and electrical installation of the 890GTR. Follow the steps for a successful installation.

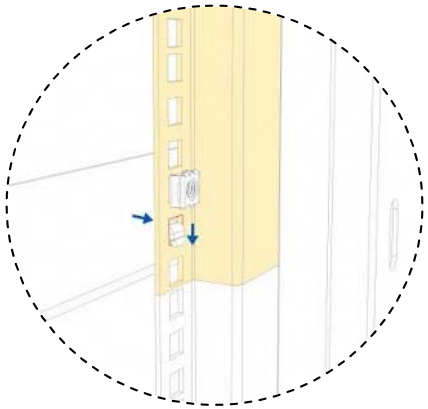
- Mechanical Installation
- Lifting Instructions
- Electrical Installation
- Start-up Sequence

Mechanical Installation

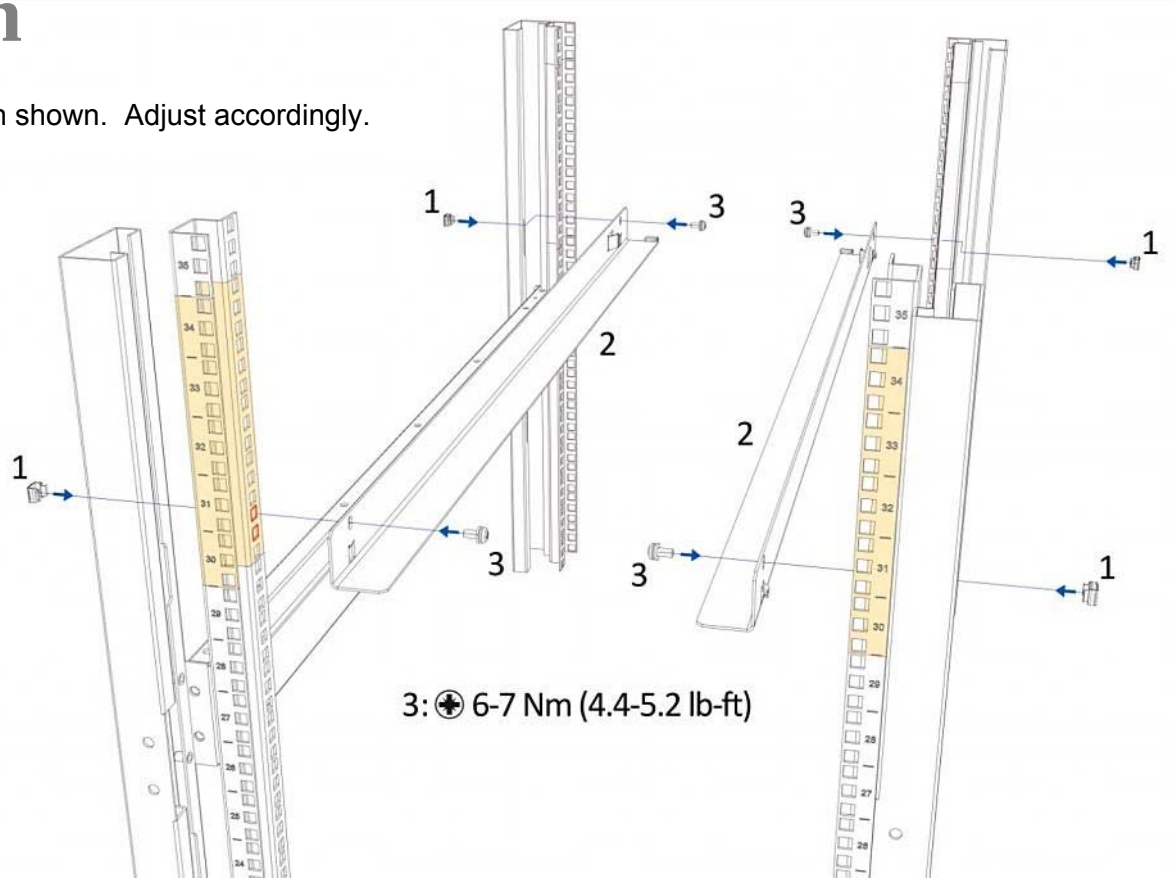
1:



2:



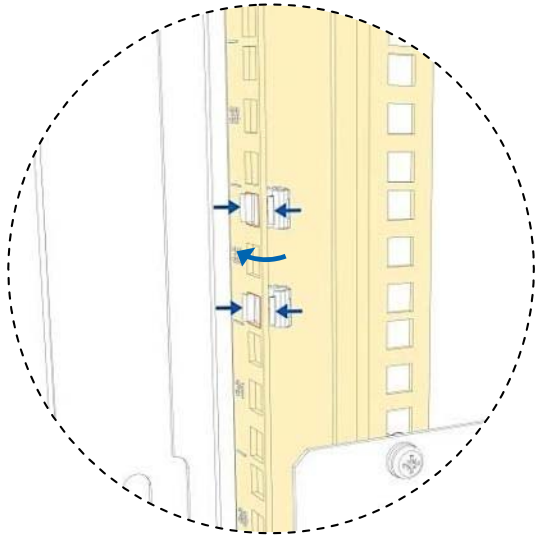
U30 location shown. Adjust accordingly.

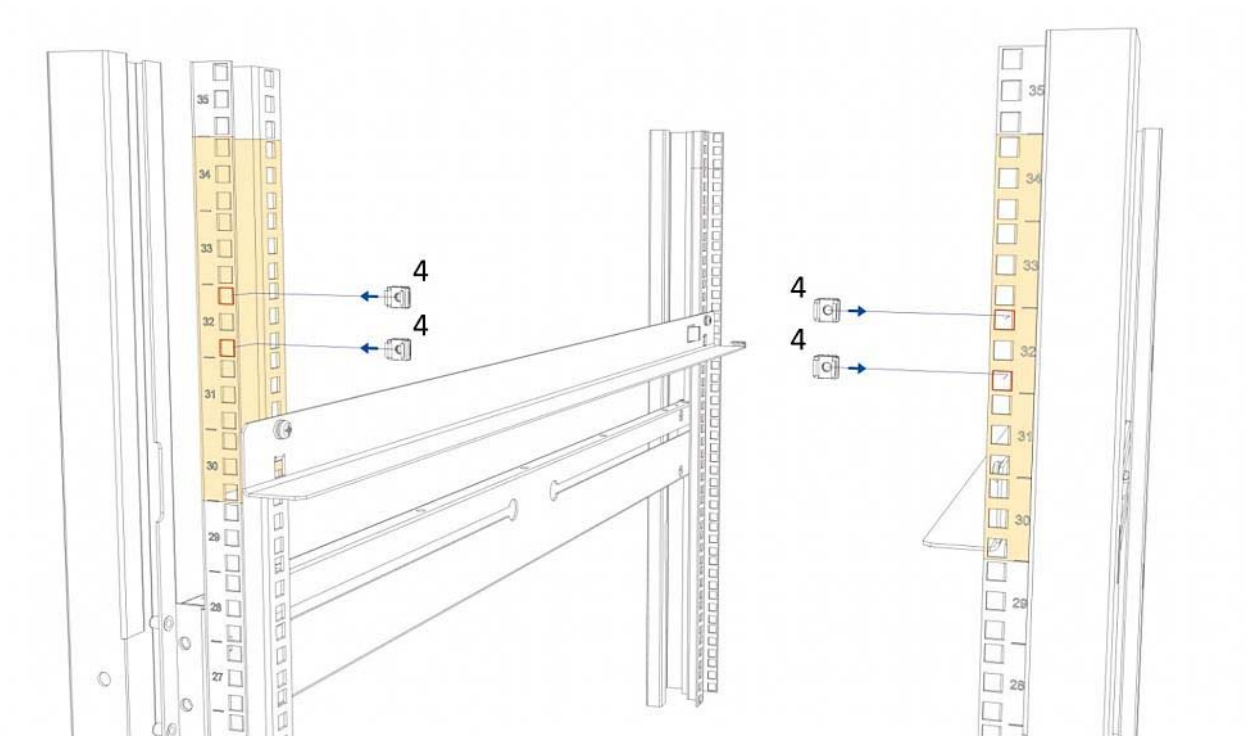


1. Install the cage nuts (FZ474257U006) into the outer side faces of the vertical rails as shown. Snap the nuts into the third opening up from the bottom of the desired installation “U” location (U30 shown).
2. Hang the rails (BX474176U001 & BX474176U002) onto the side faces of the vertical rails. Slide the hooks into the second opening up from the bottom of the desired “U” location (U30 shown). Push the rails down until the slot is aligned with the cage nut from step 1.
3. Use a pozidrive 3 screwdriver to fasten the rails using FY388805. Torque to 6-7 Nm (4.4-5.2 lb-ft).

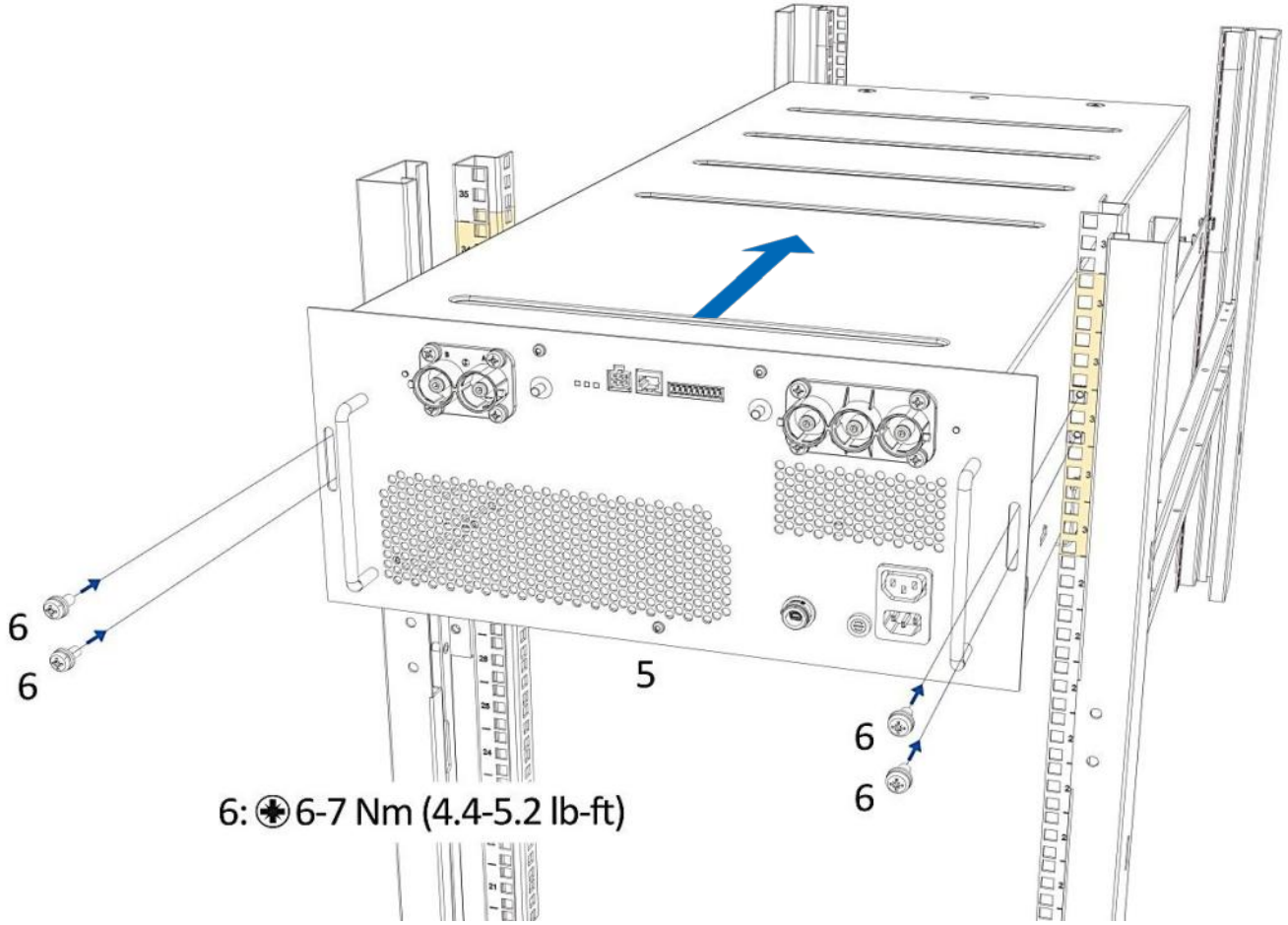
U30 location shown. Adjust accordingly.

4:



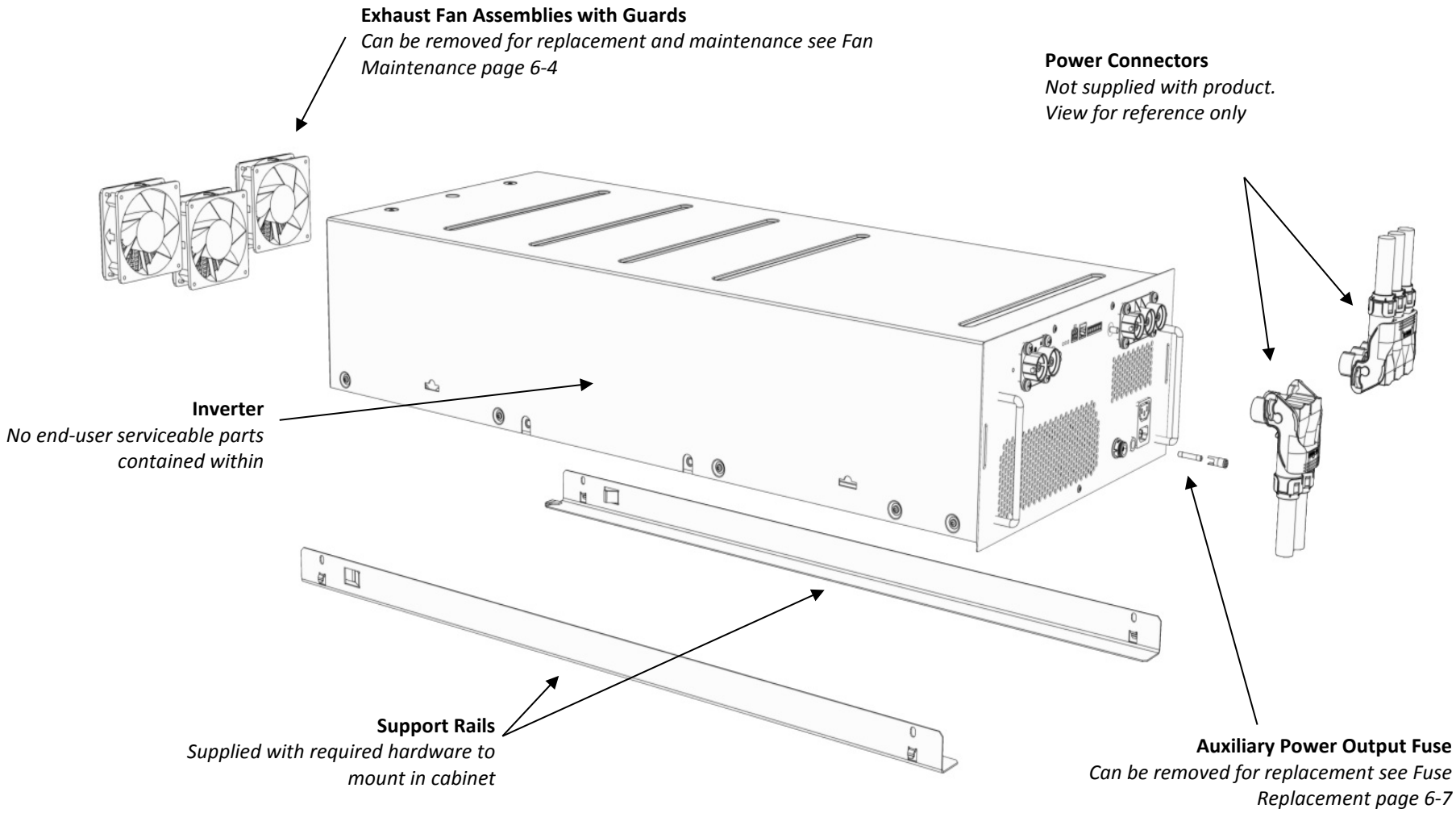


4. Install the cage nuts (FZ474257U006) into the backside of the front face of the vertical rails as shown. Snap the nuts into the seventh and ninth openings up from the bottom of the desired installation “U” location (U30 shown).



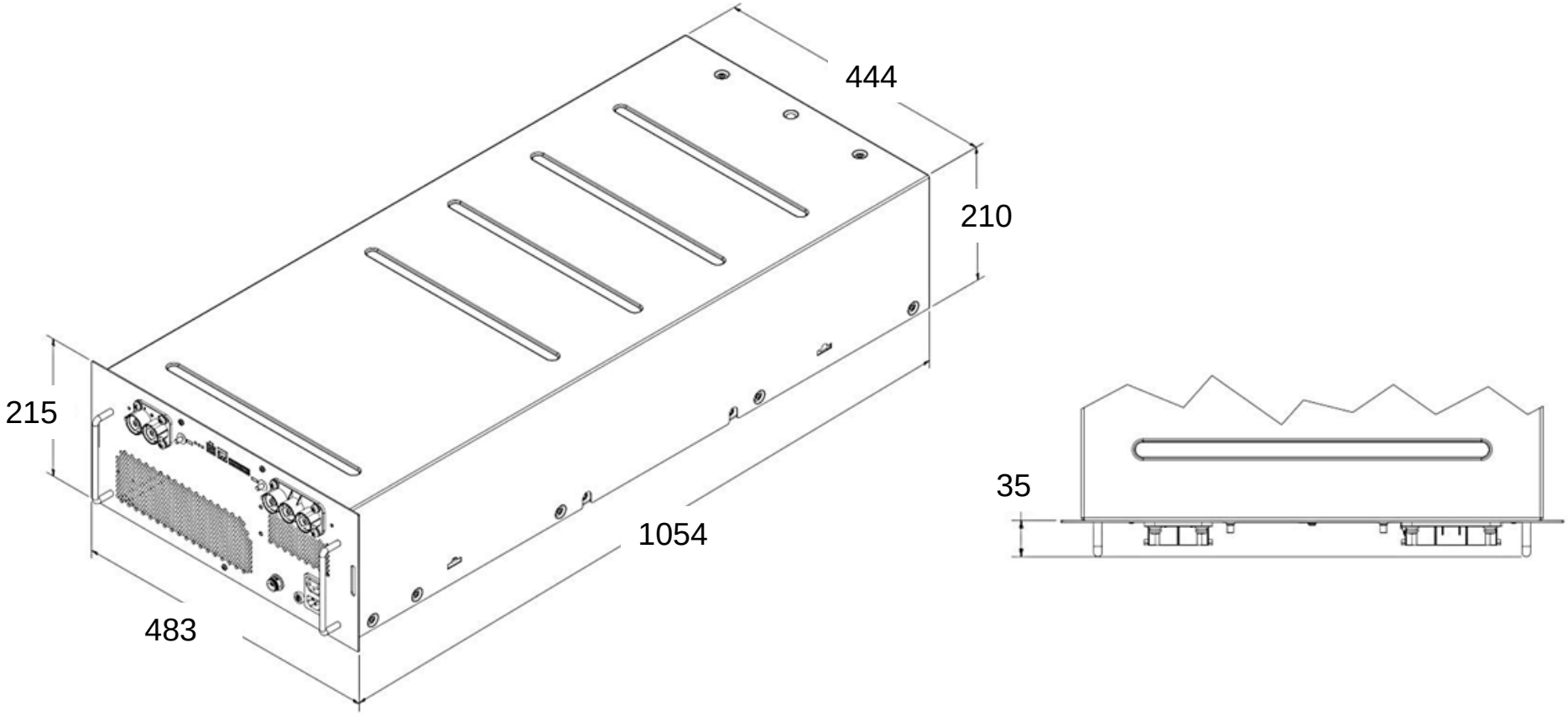
5. Install the 890GTR onto the rails and slide back into place until the front face comes in contact with the vertical rails. Caution: product has mass of 91 kg (200 lbs), see 3-7 for proper lifting instructions.
6. Use a pozidrive 3 screwdriver to fasten the 890GTR using FY388805. Torque to 6-7 Nm (4.4-5.2 lb-ft).

Layout Diagram


Exhaust Fan Assemblies with Guards
Can be removed for replacement and maintenance see Fan Maintenance page 6-4
Power Connectors
Not supplied with product.
View for reference only
Inverter
No end-user serviceable parts contained within
Support Rails
Supplied with required hardware to mount in cabinet
Auxiliary Power Output Fuse
Can be removed for replacement see Fuse Replacement page 6-7

Dimensions

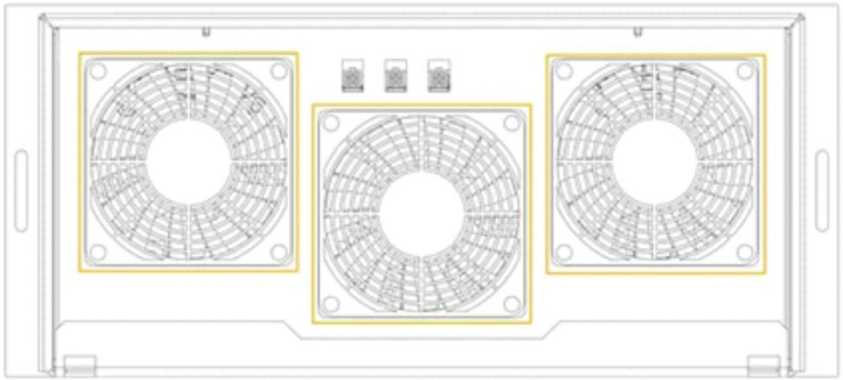
All dimensions are in mm.



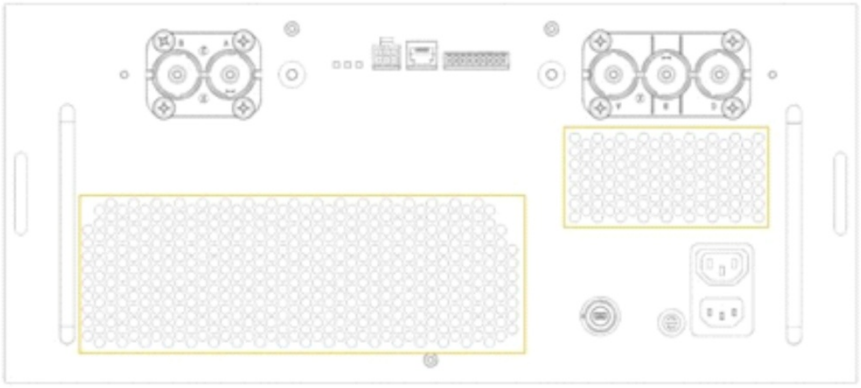
Air Flow & Ventilation Requirements

Minimum Required Air Clearance

*Excludes Power Wiring



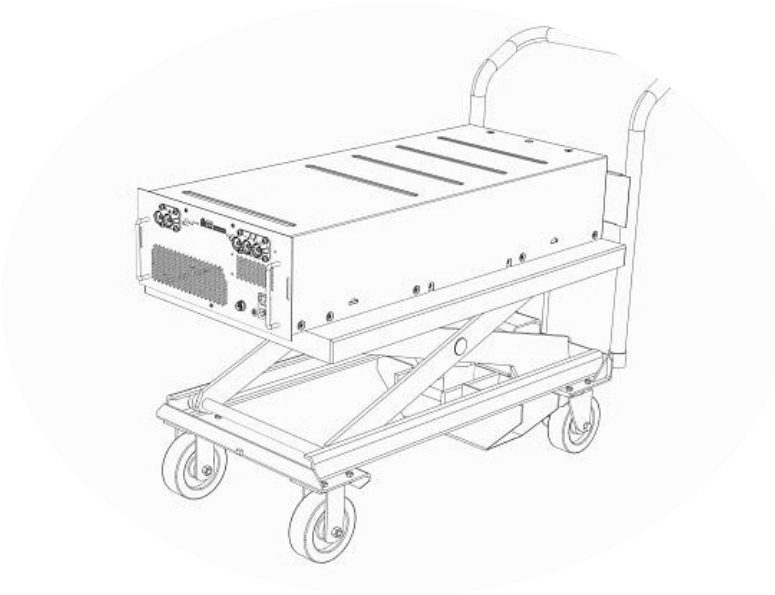
Back View
3 Fans
510 m^3/h (300 ft^3/min) Total Flow at Full Load



Front View
Minimize blockage across grills

Lifting Instructions

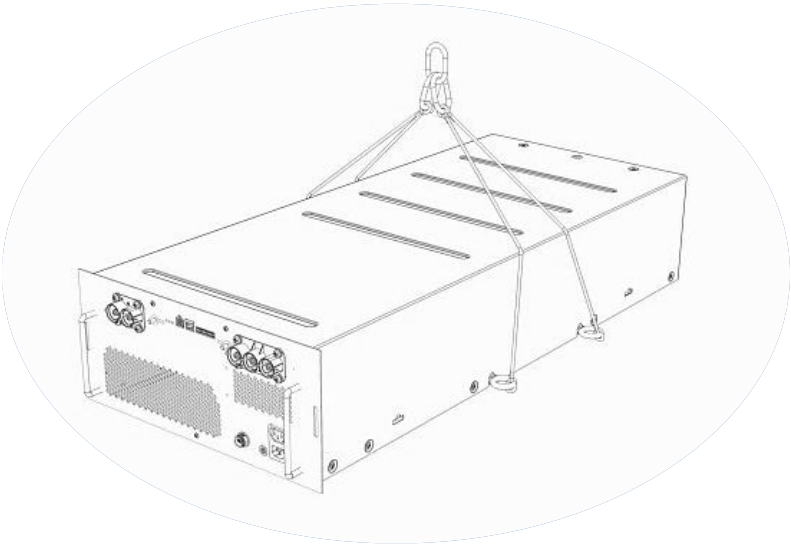
Ensure equipment is properly rated. Product mass: 91kg (200lbm).



Lifting Options

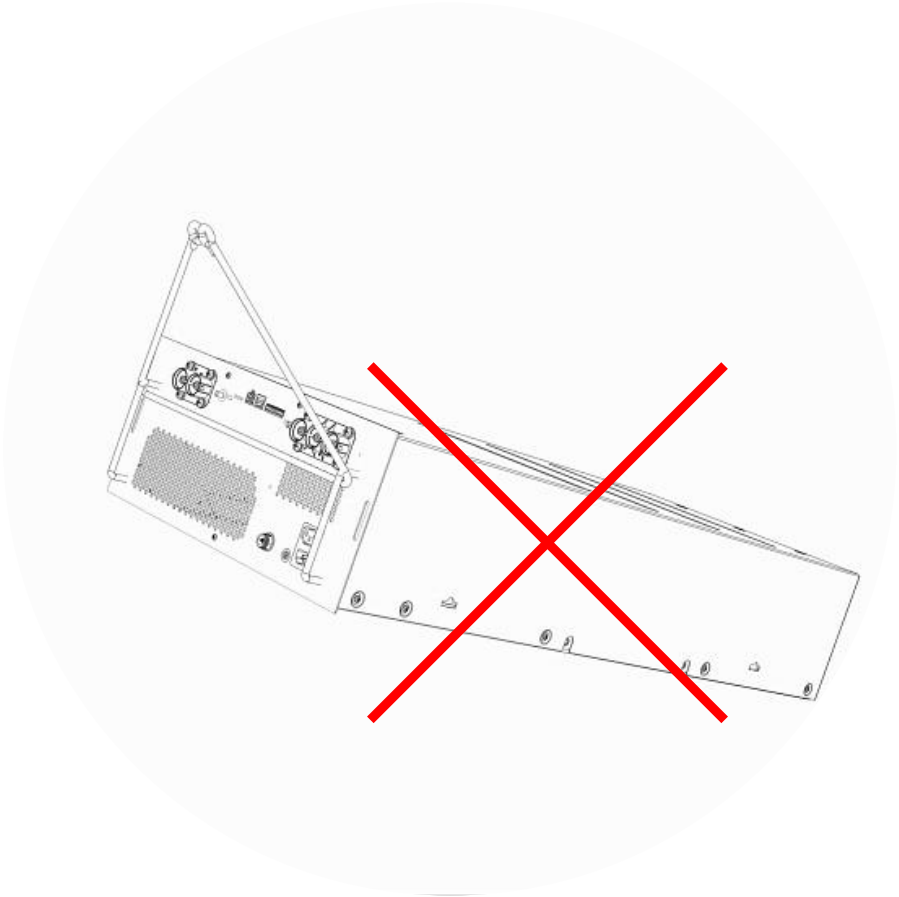
1. Product can be lifted and supported from the base surface.

2. Can be lifted by eyebolts screwed into sides. See lifting dimensions for details (3-10). Torque eyebolts to 16-17 Nm (11.8-12.5 lb-ft).



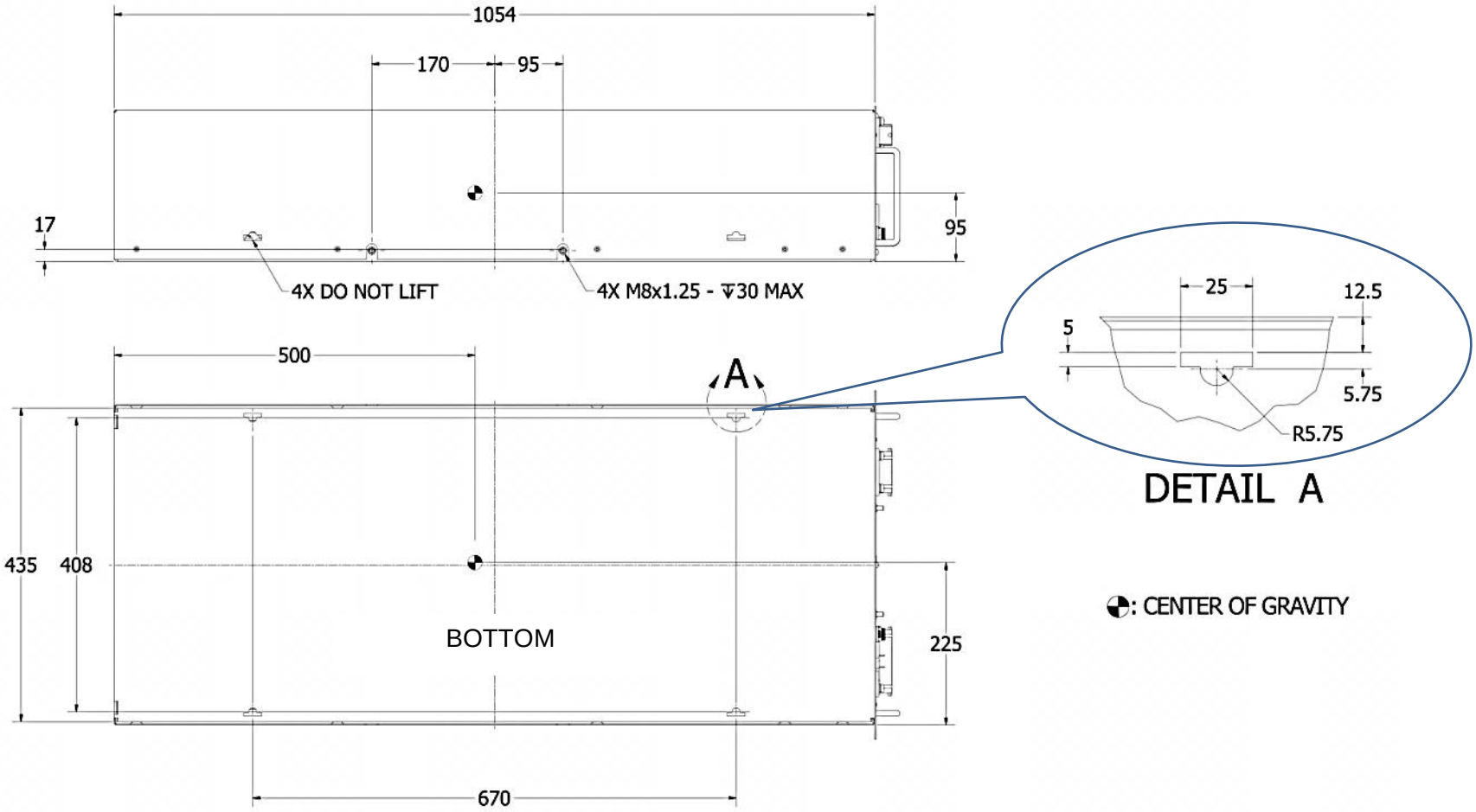
3. Lifted by cutouts in base surface using hooks. See lifting dimensions for details (3-10).

Product cannot be lifted by handles. Handles are intended only to push or pull product on cabinet rails.



Lifting Dimensions

All dimensions in mm.



Electrical Installation

IMPORTANT **Please read the Safety Information on in Chapter 1 before proceeding.**

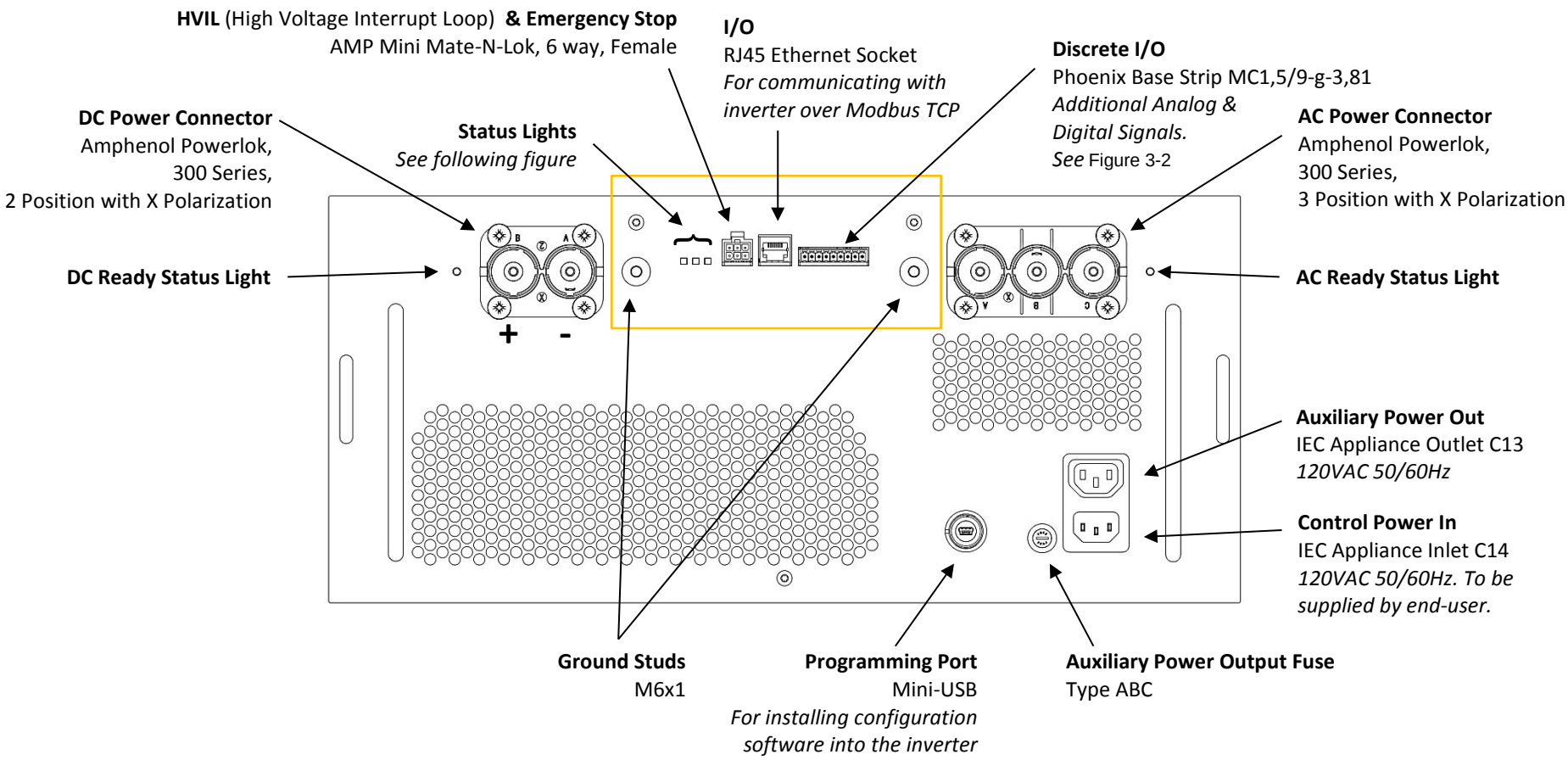


Figure 3-1 Layout Diagram

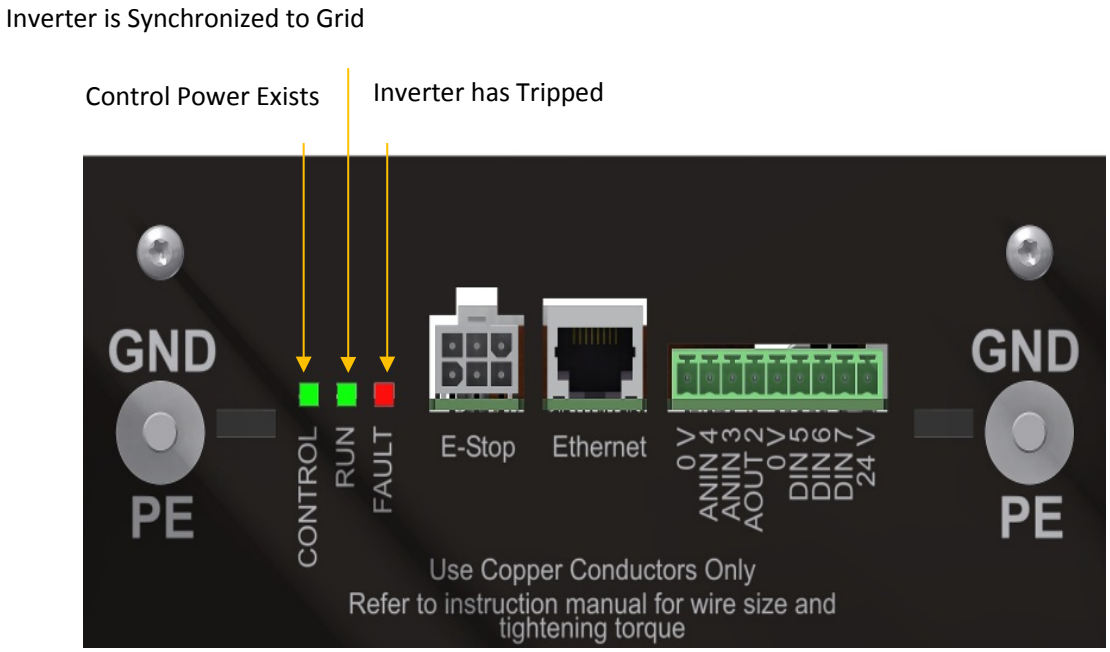

Inverter is Synchronized to Grid
Control Power Exists
Inverter has Tripped
GND
PE
CONTROL
RUN
FAULT
E-Stop
Ethernet
0 V
4 ANIN
3 ANIN
2 AOUT
0 V
5 DIN
6 DIN
7 DIN
24 V
GND
PE
Use Copper Conductors Only
Refer to instruction manual for wire size and tightening torque

Figure 3-2

Wiring Requirements

****WARNING: Parker Inverters must be installed using wiring methods according to the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, or other appropriate local or national electrical codes. It is the responsibility of the installer to ensure installation is designed and performed in compliance with these standards.**

Function	Wire size**	Mating Connector	Notes
DC Ground	Minimum 21.2 mm^2 wire (4 AWG)	Wire Lug	Tightening torque 6-7 Nm (4.4-5.2 lb-ft)
AC Ground	Minimum 13.3 mm^2 wire (6 AWG)	Wire Lug	Tightening torque 6-7 Nm (4.4-5.2 lb-ft)
DC Bus Connection	Minimum 33.6 mm^2 (2 AWG)	Amphenol Powerlok, 300 Series, 2 Position with X Polarization	Maximum continuous current = $160A_{DC}$
AC Bus Connection	Minimum 33.6 mm^2 (2 AWG)	Amphenol Powerlok, 300 Series, 3 Position with X Polarization	Maximum continuous current = $128A_{RMS}$
HVIL & Emergency Stop	Minimum 0.3 mm^2 (22 AWG) Maximum 0.8 mm^2 (18 AWG)	AMP 172168-1 (Mini Mate-N-Lok Housing)	AMP 770988-1 (crimp socket, 18-22 AWG)
Discrete I/O	Minimum 0.14 mm^2 (28 AWG) Maximum 1.5 mm^2 (16 AWG)	Phoenix Contact 1803646 (MC 1,5/9-ST-3,81)	
Auxiliary Power Out	Minimum 2.1 mm^2 (14 AWG)	IEC type C14 (male)	Rated output = 120V, 750VA, 50/60Hz
Auxiliary Power In	Minimum 2.1 mm^2 (14 AWG)	IEC type C13 (female)	120V (+/-5%), 150VA, 50/60Hz
Communication Port	Cat5 w Shield Ethernet Cable	RJ-45	
Programming Port	Mini-USB	Mini-USB	

DC connection notes:

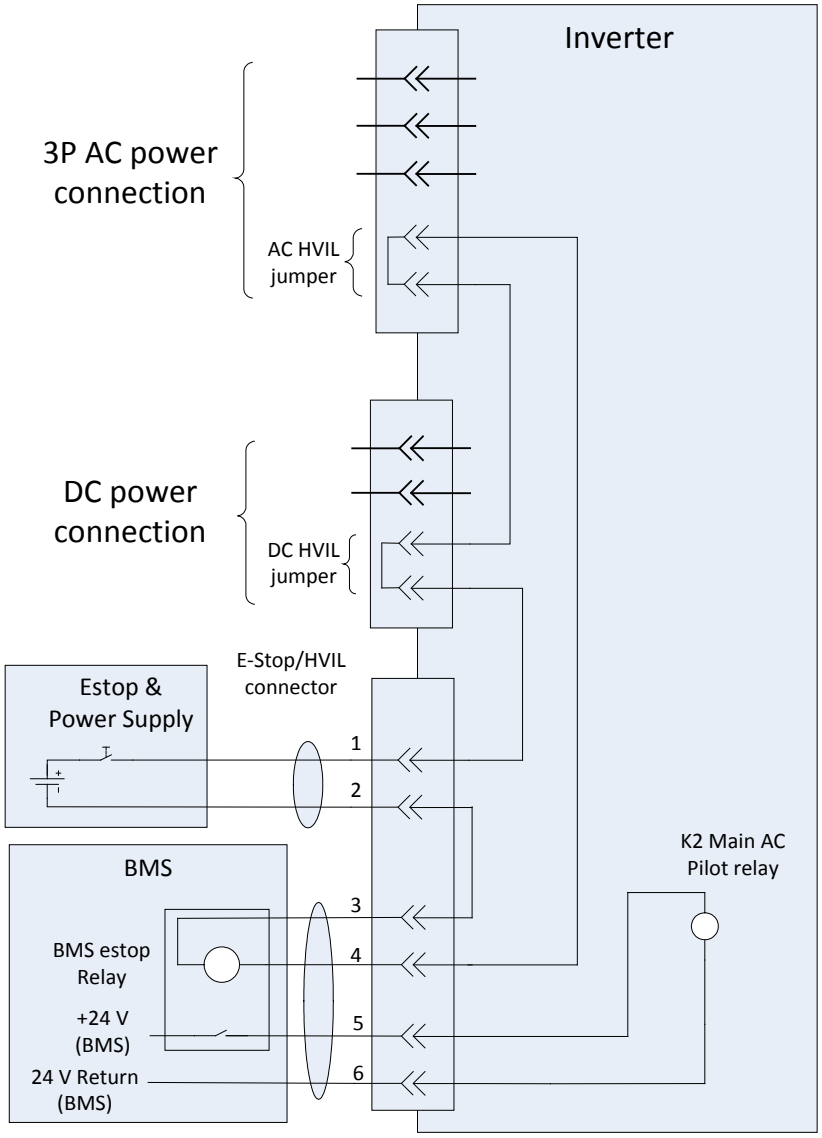
1. Verify correct polarity before connecting to the DC bus. Improper DC polarity could result in damage to the inverter and/or DC supply.
2. DC supply must provide a method to pre-charge the DC bus capacitors contained within the inverter. Failure to properly pre-charge the inverter will result in high inrush currents possibly damaging the inverter.
3. External fusing or breaker is required for the DC connection.
4. Lethal voltages and energies are present in this equipment. It is the responsibility of the installer to follow the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, and/or other appropriate local and national electrical codes.
5. It is the responsibility of the operator of this equipment to ensure adequate safety procedures and Arc Flash precautions are followed.

AC connection notes:

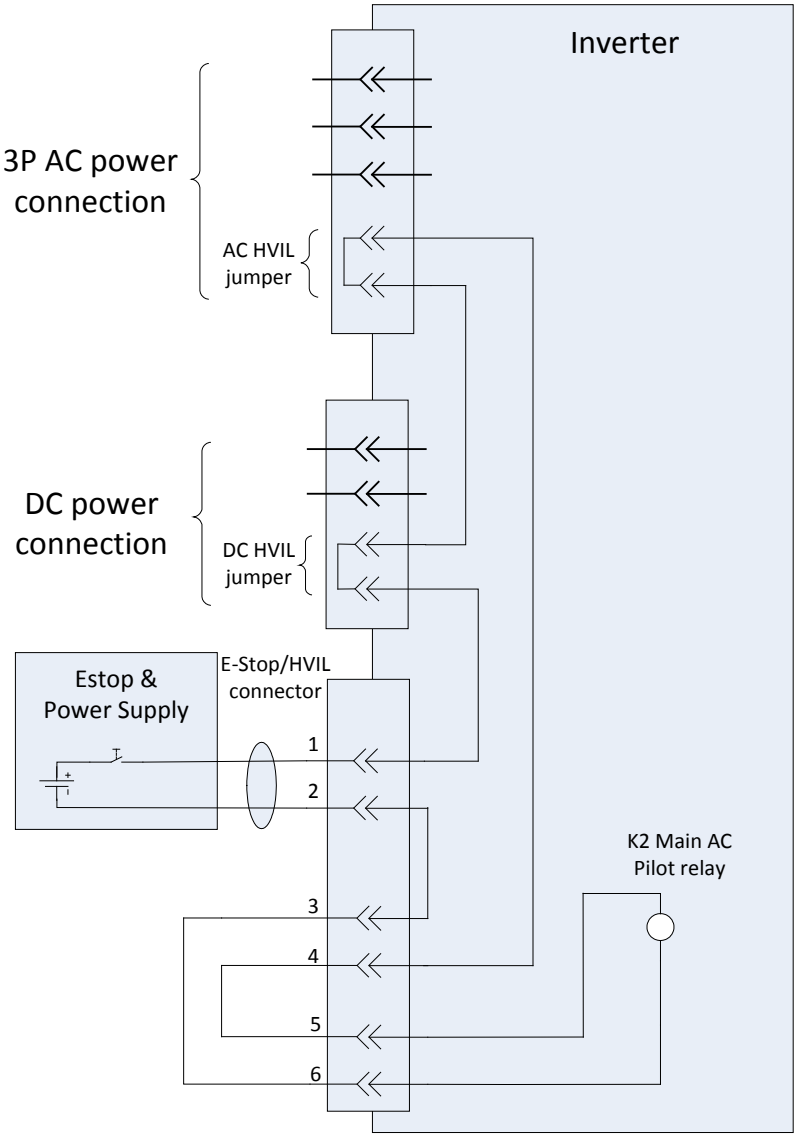
1. AC polarity (phase rotation) is automatically detected and accommodated by the inverter.
2. AC supply must have appropriate disconnection and fusing. Refer to NEC and all applicable codes
3. Lethal voltages and energies are present in this equipment. It is the responsibility of the installer to follow the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, and/or other appropriate local and national electrical codes.
4. It is the responsibility of the operator of this equipment to ensure adequate safety procedures and Arc Flash precautions are followed.

Estop/HVIL connection notes:

1. Although the Estop and HVIL circuits are galvanically isolated from the inverter control circuits, it is recommended that they are referenced to ground potential.
2. Estop circuit requires external 24 Vdc but is polarity insensitive.
3. HVIL circuit utilizes isolated contacts in both AC and DC power connectors. External 24 Vdc power supply is recommended. The following figure illustrates two possible connections schemes:



Proposed E-Stop & HVIL Circuit w BMS



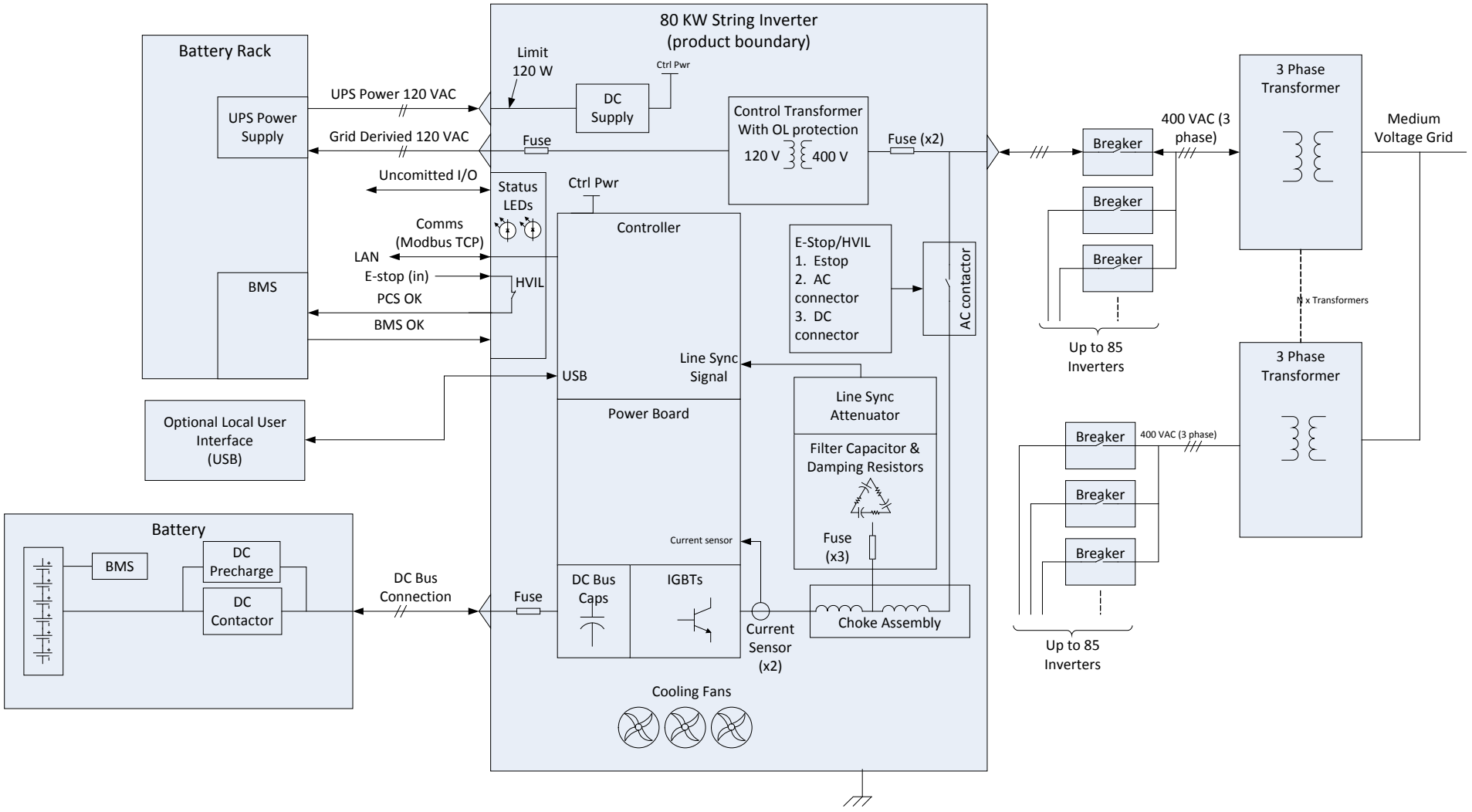
Proposed E-Stop & HVIL Circuit w/o BMS

Example E-Stop & HVIL Circuit

Auxiliary I/O connection notes:

Signal	Range	Description	Notes
AIN3	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 3	(unassigned)
AIN4	±10V, 0-10V, 0-20mA, 4-20mA	Analog Input 4	Available as special order (consult factory)
DIN5	0-24 Vdc	Digital Input 5	0V or open = False; +24V = True (unassigned)
DIN6	0-24 Vdc	Digital Input 6	0V or open = False; +24V = True (unassigned)
DIN7	0-24 Vdc	Digital Input 7	0V or open = False; +24V = True (unassigned)

Functional Overview / Block Diagram



String Inverter System Block Diagram

Start-up Sequence

Proper power up and starting sequence is required to successfully connect the DC supply with the Grid. Failure to follow an acceptable sequence could result in damage to the inverter or associated equipment.

1. **Apply control power**—connect 120 Volt 50/60 Hz ac power to “control power in”. This supply is typically an Uninterruptable Power Supply (UPS) for black start and VRT features. Maximum control power requirements: 120 Watts (150 VA).
2. **Ensure Estop/EPO circuit is satisfied**—an external 24 Volt DC supply is required to engage the main AC contactor. This input is usually used in conjunction with a normally closed Estop pushbutton. Additionally, the High Voltage Interrupt Loop contacts should be included in the Estop circuit. See Estop/EPO 3-14.
3. **Close dc bus pre-charge contactor—**the DC bus capacitors need to be pre-charged through a current limited circuit (i.e. resistor) to prevent excessively high in-rush currents. Failure to properly pre-charge the bus could result in damage to the inverter or associated equipment.
4. **Ensure dc bus voltage is equal to DC supply voltage (+/-5%)—**verify the dc bus is properly charged by query of the DC LINK VOLTS parameter through the Modbus communication link.
5. **Close dc main contactor—**once the DC bus is fully charged, then the main DC contactor can be closed. This contactor is part of the DC supply.
6. **Disengage dc pre-charge contactor—**opening the pre-charge contactor after closing the DC main contactor is recommended to prevent damage to the pre-charge circuit in case the main contact opens unexpectedly.
7. **Ensure both start and stop bits are cleared—**the Modbus Start Request and Stop Request parameters are rising edge sensitive and it is good practice to initialize them before attempting a start.
8. **Clear faults—**send a Fault Reset command to clear any extraneous faults that may have occurred during the startup sequence.
9. **Verify faults are all cleared—**read the Tripped bit to ensure all faults are cleared. Correct any persistent faults before proceeding.
10. **Toggle start bit true then false—**the Start Request bit is rising edge sensitive. It is good practice to return the start bit to false once a request is sent.

11. **Wait 2 seconds—**there are two 1 second delays built into the start up configuration. Therefore it may take at least two seconds before the inverter actually starts and indicates a Running condition.
12. **Verify inverter running—**read the Running bit to make sure the inverter is enabled and connected to the grid.
13. **Select Control Mode—**select either Id/Iq or KW/KVAR control.
14. **Set Output Demand—**set either Id/Iq or KW/KVAR to desired level.

Chapter 4 Operations

- Utility Interconnection and Grid Fault Interface
- Normal Grid Operation
- Voltage Ride Through Behaviour
- Frequency Ride through Behaviour
- Anti-Islanding Behaviour
- Emergency Power Off (EPO)

Utility Interconnection and Grid Fault Interface

Normal Grid Operation

Energy is transmitted back and forth to the grid through power, reactive power, or power factor commands delivered to the inverter via network communications or through discrete I/O. The 890GTR will attempt to meet the requested real power, reactive power or power factor commands unless a system or device protection setting or algorithm prevents the inverter from achieving the desired output. See table on page E-4 for environmental derating that may limit inverter output. In addition, parameters from the energy storage supply like charge and discharge limits may override commanded system output. A full list of parameters can be found in Appendix B.

Voltage Ride Through Behaviour

A graph of pre-programmed and allowable voltage ride through settings can be found in Appendix E and in the Version 5 Firmware manual. In the event of a grid voltage fault, the inverter will respond in the following manner:

Faults within the programmed trip time and voltage limits:

The inverter will respond in 1 of 3 ways.

1) Symmetric 3 phase fault with the "*LVRT k"* parameter in the Grid Control Function Block Menu set to 0: the inverter will attempt to provide the pre-fault power and reactive power or power factor to within the current limits of the inverter. In the event of excessive current required, the 890GTR will reduce reactive power and then real power to stay within the current limits of the product.
2) Asymmetric fault: The inverter will remain synchronized to the grid but cease to export real power during the fault. Reactive power from the internal capacitors will be present during the fault.
3) Symmetric 3 phase fault with the "*LVRT k"* parameter in the Grid Control Function Block Menu set to 1 or higher: the inverter will output additional reactive current in proportion to the magnitude of the fault scaled by the *"LVRT k"* parameter and use any remaining output current capacity to achieve the pre-fault power output setpoint. For example: a product rated for 1000A output on a grid is outputting 300A of real power current and 100A of inductive reactive current and has its LVRT k parameter set to 1. If the grid experienced a symmetric 3 phase fault causing its voltage to drop down to 50% of its nominal value the inverter will: add 1*(50%*1000A)=500A of capacitive reactive current to its

per fault 100A output = 100A-500A = 400A of capacitive current. Power = Volts * Current so the drop in voltage of 50% requires the inverter to increase its real power current by 50% to maintain the same power output so its real power current will go to 300A / 50% = 600A. Since real and reactive current components are added in quadrature the inverter net output current will be SQRT(400^2 + 600^2) = 721A. For another example: a product rated for 1000A output on a grid is again outputting 300A of real power current and 100A of inductive reactive current and has its LVRT k parameter set to 2. If the grid experienced a symmetric 3 phase fault causing its voltage to drop down to 50% of its nominal value the inverter will: add **2***(50%*1000A)=1000A of capacitive reactive current to its per fault 100A output = 100A-1000A = 900A of capacitive current. Power = Volts * Current so the drop in voltage of 50% requires the inverter to increase its real power current by 50% to maintain the same power output so its real power current would have to go to 300A / 50% = 600A. In this case, since real and reactive current components are added in quadrature and reactive current takes priority during a grid fault, the available inverter real power output current can only be be SQRT(1000^2 - 900^2) = 435.9A so the inverter will output 900A of inductive reactive current and 435.9A of real power current for a total of 1000A net current. The inverter will react the same way to high voltage faults with the exception that the additional reactive current supplied during the fault will be inductive.

Faults outside the programmed trip time and voltage limits:

If a fault exceeds the programmed time duration with respect to the fault magnitude, or if the voltage exceeds the instantaneous overvoltage trip levels, the inverter will transition to the Stop Fault state and indicate a VRT mains loss fault. The 890GTR will not reconnect to the grid until after the grid has returned to within Range B of ANSI C84.1-1995, Table 1 and a frequency range of 59.3Hz to 60.5Hz if connected to a 60 Hz grid or 49.3Hz to 50.5Hz if connected to a 50Hz grid AND the grid has remained in this range for the programmed time delay. See Appendix E (page no. E-15) and the Firmware Version 5 manual for the standard delay and adjustable delay length ranges.

Frequency Ride through Behaviour

The inverter is capable of sustaining real and reactive power output in the event of grid frequency deviation. See Appendix E to see the standard settings and upper and lower limits of operation. Standard as shipped 890GTRs do not have pre-programmed or desired output change due to frequency deviation algorithms active. Consult Parker (page no. 2-2) for specific frequency ride through behaviour requests.

Anti-Islanding Behaviour

WARNING: The 890GTR is shipped with anti-islanding capability disabled. It is the responsibility of the site operator to detect and remove island conditions. Please consult Parker (page no. 2-2) to discuss turning the anti-island detection algorithm on.

In the event of an island condition, if the anti-islanding detection algorithm has been enabled by the factory, the 890GTR will detect the formation of the island within 2 seconds of its creation. The inverter will transition to a Stop Fault state and cease the export of power. The 890GTR will not reconnect to the grid until after the grid has returned to within Range B of ANSI C84.1-1995, Table 1 and a frequency range of 59.3Hz to 60.5Hz if connected to a 60 Hz grid or 49.3Hz to 50.5Hz if connected to a 50Hz grid AND the grid has remained in this range for the programmed time delay. See Appendix E and the Firmware Version 5 manual for the standard delay and adjustable delay length ranges.

Modbus Register Maps

Read Map:

890GTR													
	Holding Reg.					Word			Byte			Bit
Description	Address		Type	Condition	Scale / Units							
DC Link Volts	257		Real		Volts DC	0	-	1	0	-	3	~
Mains Current	259		Real		Amps AC (From Inv)	2	-	3	4	-	7	~
Terminal Volts	261		Real		Volts AC (From Inv)	4	-	5	8	-	11	~
Actual Current Limit	263		Real		%	6	-	7	12	-	15	~
Heatsink Temperature (Hottest IGBT)	265		Real		Degrees Celsius	8	-	9	16	-	19	~
First Trip	267		Dword		Enumerated Value --->	10	-	11	20	-	23	~
Status Word 1	269		Dword		Bitwise	12	-	13	24	-	27	~

Read Map (continued):

Running	269	.00	Bool	Maintained	1 = Running	12	24	0
Tripped		.01	Bool	Maintained	1 = Tripped			1
Synchronized		.02	Bool	Maintained	1 = Synchronized			2
Close Precharge		.03	Bool	Maintained	1 = Close Precharge			3
Current Control		.04	Bool	Maintained	1 = Current Control			4
Inverter Enabled		.05	Bool	Maintained	1 = Drive Enabled			5
Hardware Sync		.06	Bool	Maintained	1 = Hardware Sync			6
10M1 Status		.07	Bool	Maintained	1 = Contactor Closed			7
Fan Failure		.08	Bool	Maintened	1 = Fan Failure		25	8
E-Stop Status		.09	Bool	Maintained	1 = E-stop OK			9
DIN5 Status		.10	Bool	Maintained	1 = ON			10
DIN6 Status		.11	Bool	Maintained	1 = ON			11
DIN7 Status		.12	Bool	Maintained	1 = ON			12
Local Sequence		.13	Bool	Maintained	1 = Local sequence active (keypad)			13
		.14	Bool					14
		.15	Bool					15
Watchdog	270	.00	Bool	Pulse Train	333mS On 333mS Off	13	26	16
		.01	Bool					17
		.02	Bool					18
		.03	Bool					19
Grid Mode		.04	Bool	Maintained	1 = Grid Mode			20
Island Mode		.05	Bool	Maintained	1 = Island Mode			21
DC Overvoltage		.06	Bool	Maintained	1 = Overvoltage Fault			22
DC Undervoltage		.07	Bool	Maintained	2 = Undervoltage Fault			23
		.08	Bool				27	24
		.09	Bool					25
		.10	Bool					26
		.11	Bool					27
		.12	Bool					28
		.13	Bool					29
		.14	Bool					30
		.15	Bool					31

Inverse Time OP	271		Real		%	14	-	15	28	-	31	~
i*t area	273		Unknown		Unknown	16	-	17	32	-	35	~
Air Outlet Temperature	275		Real		C	18	-	19	36	-	39	~
Analog Input 3	277		Real		%	20	-	21	40	-	43	~
Analog Input 4	279		Real		%	22	-	23	44	-	47	~
Analog Output 2	281		Real		%	24	-	25	48	-	51	~

Write Map:

890GTR								
	8902/IM					Word	Byte	Bit
Description	Address		Type	Condition	Scale / Units			
Command Word	1		DWord		Bitwise	0 - 1	0 - 3	~
Start Request	1	.00	Bool	Momentary	1 = Start	0	0	0
Stop Request		.01	Bool	Momentary	1 = Stop			1
Fault Reset		.02	Bool	Momentary	1 = Reset			2
Voltage Control		.03	Bool	Maintained	1 = DC Voltage Control Mode			3
kW/kVAR Control		.04	Bool	Maintained	1 = kW / kVAR Control			4
		.05	Bool					5
		.06	Bool					6
		.07	Bool					7
		.08	Bool				1	8
		.09	Bool					9
		.10	Bool					10
		.11	Bool					11
		.12	Bool					12
		.13	Bool					13
		.14	Bool					14
		.15	Bool					15
Watchdog	2	.00	Bool	Pulse Train	1 HZ Pulse Train	1	2	16
		.01	Bool					17
		.02	Bool					18
		.03	Bool					19
		.04	Bool					20
		.05	Bool					21
		.06	Bool					22
		.07	Bool					23
		.08	Bool				3	24
		.09	Bool					25
		.10	Bool					26
		.11	Bool					27
		.12	Bool					28
		.13	Bool					29
		.14	Bool					30
		.15	Bool					31

Write Map (continued):

Id Demand	3		Real	~	+- 1.0 = +- Inverter Rated Current	2	-	3	4	-	7	~
Iq Demand	5		Real	~	+- 1.0 = +- Inverter Rated Current	4	-	5	8	-	11	~
DC Volts Demand	7		Real	~	Volts DC	6	-	7	12	-	15	~
kW Demand	9		Real	~	kW AC	8	-	9	16	-	19	~
kVAR Demand	11		Real	~	kVAR AC	10	-	11	20	-	23	~
Nominal Line Voltage	13		Real	~	Nominal Vac (380Vac to 420Vac)	12	-	13	24	-	27	~
Filter capacitance	15		Real	~	uF, 40 is nominal. 0 to turn off filter compensation	14	-	15	28	-	31	~
I Loop Prop Gain	17		Real	~	0.15 nominal	16	-	17	32	-	35	~
I Loop Int Gain	19		Real	~	0.02 nominal	18	-	19	36	-	39	~
LVRT Trip 1 dt	21		Real	~	seconds, 0.16 nominal	20	-	21	40	-	43	~
LVRT Trip 2 dt	23		Real	~	seconds, 0.16 nominal	22	-	23	44	-	47	~
LVRT Trip 3 dt	25		Real	~	seconds, 1.0 nominal	24	-	25	48	-	51	~
LVRT Trip 4 dt	27		Real	~	seconds, 2.0 nominal	26	-	27	52	-	55	~
LVRT Trip 1 Volts	29		Real	~	per unit voltage, 0.44 nominal	28	-	29	56	-	59	~
LVRT Trip 2 Volts	31		Real	~	per unit voltage, 0.45 nominal	30	-	31	60	-	63	~
LVRT Trip 3 Volts	33		Real	~	per unit voltage, 0.60 nominal	32	-	33	64	-	67	~
LVRT Trip 4 Volts	35		Real	~	per unit voltage, 0.88 nominal	34	-	35	68	-	71	~
HVRT Nom Volts	37		Real	~	per unit voltage, 1.1 nominal	36	-	37	72	-	75	~
HVRT Trip 1 Volts	39		Real	~	per unit voltage, 1.2 nominal	38	-	39	76	-	79	~
HVRT Max Volts	41		Real	~	per unit voltage, 1.3 nominal	40	-	41	80	-	83	~
HVRT Nom dt	43		Real	~	seconds, 1.0 nominal	42	-	43	84	-	87	~
HVRT Trip 1 dt	45		Real	~	seconds, 0.16 nominal	44	-	45	88	-	91	~
Over Freq Trip 1	47		Real	~	Hz, 60.5 or 50.5 nominal	46	-	47	92	-	95	~
Over Freq Trip 2	49		Real	~	Hz, 62 or 52 nominal	48	-	49	96	-	99	~
Over Freq Trip 1 Time	51		Real	~	seconds, 0.16 nominal	50	-	51	100	-	103	~
Over Freq Trip 2 Time	53		Real	~	seconds, 2.0 nominal	52	-	53	104	-	107	~
Under Freq Trip 1	55		Real	~	Hz, 59.5 or 49.5 nominal	54	-	55	108	-	111	~
Under Freq Trip 2	57		Real	~	Hz, 57 or 47 nominal	56	-	57	112	-	115	~
Under Freq Trip 1 Time	59		Real	~	seconds, 2.0 nominal	58	-	59	116	-	119	~
Under Freq Trip 2 Time	61		Real	~	seconds, 0.0 nominal	60	-	61	120	-	123	~
K Factor	63		Real	~	gain of reactive current during VRT. 0 nominal.	62	-	63	124	-	127	~

Emergency Power Off (EPO)

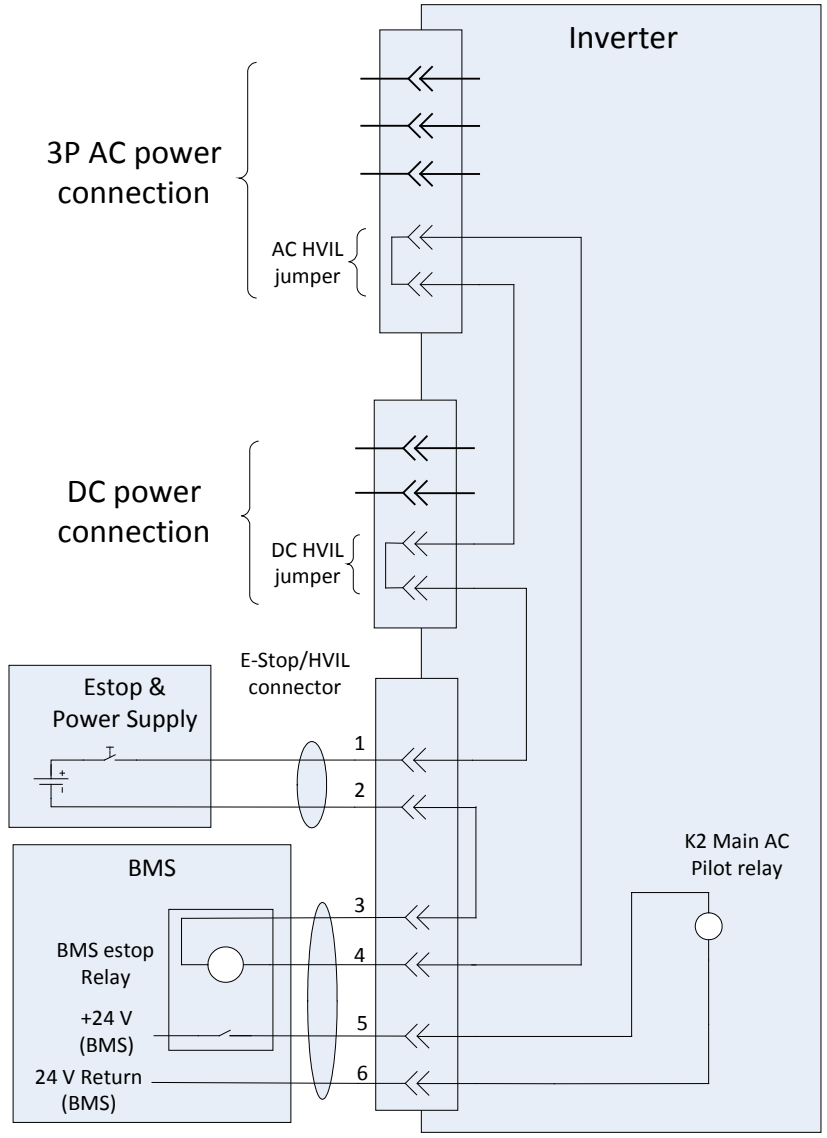
80 KW String Inverter

The 890GTR is equipped with an Emergency Power Off (EPO) circuit and High Voltage Interrupt Loop (HVIL) circuit.

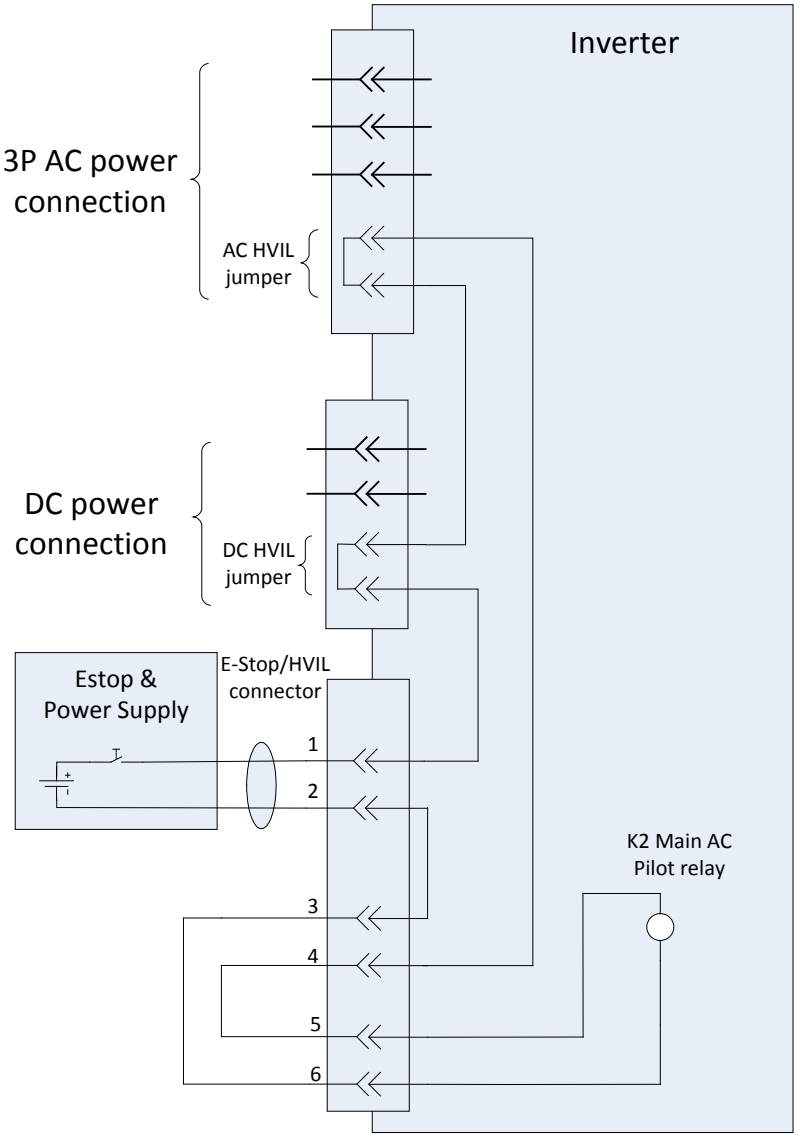
The EPO circuit relies on the presence of an external 24 volt dc supply to maintain a healthy condition. If this supply is interrupted, the 890GTR AC contactor immediately opens, disconnecting the Grid power. This action is accomplished through a direct hardware connection and does not require software to function. However, the 890GTR software does monitor the EPO condition and will disable the inverter if EPO 24 volt dc is not present. **Note: EPO circuit does not disconnect the DC supply or the AC control power. Removal of DC and/or control power should be incorporated in the system design if required.**

The HVIL circuit is made up of two “dry” contacts integrated into the power connectors. If either power connector is not fully engaged, then the HVIL circuit will open. It is recommended that the EPO and HVIL circuits are used together such that a break in the HVIL circuit will also open the EPO circuit.

On the next page is a schematic representation of both EPO and HVIL circuits. Please note both EPO and HVIL circuits are polarity insensitive.



Proposed E-Stop & HVIL Circuit w BMS



Proposed E-Stop & HVIL Circuit w/o BMS

Example E-Stop & HVIL Circuit

Chapter 5 Trips & Fault Finding

The following tables can be used to troubleshoot a loss of function, possibly due to a tripped circuit breaker or blown fuse. They list the component identifier used in the circuit diagrams and the type, rating and location of each device.

- Trips
- Trips Table
- Fault Finding

Trips

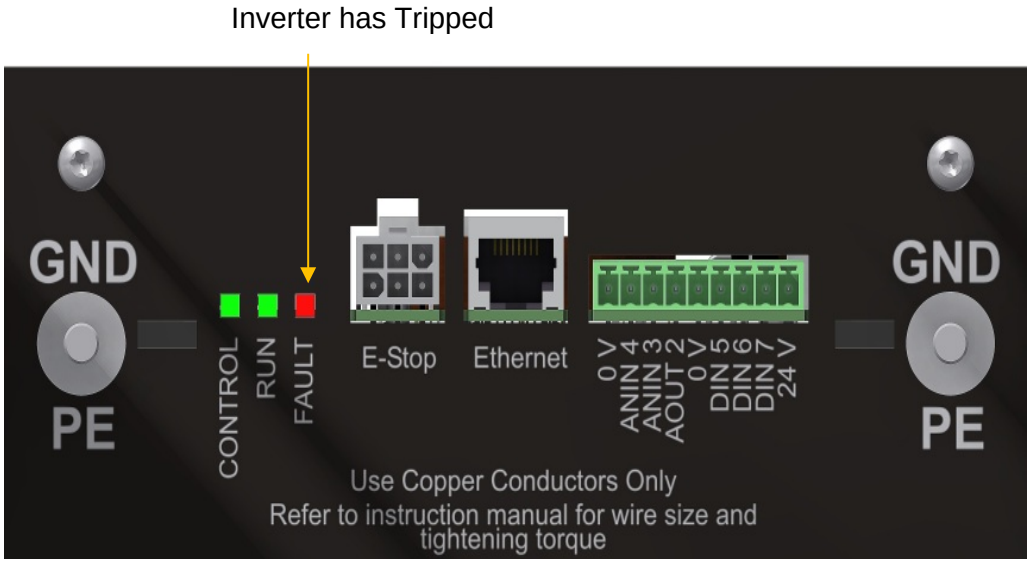
What Happens when a Trip Occurs

When a trip occurs, the inverter's power stage is immediately disabled causing output to stop. The trip is latched until action is taken to reset it. This ensures that trips due to transient conditions are captured and the inverter is disabled, even when the original cause of the trip is no longer present

Inverter Indications

If a trip condition is detected the unit displays and performs the following actions.

1. The programming block SEQ & REF::SEQUENCING LOGIC::TRIPPED signal is set to TRUE.
2. The FIRST TRIP parameter in the TRIPS STATUS function block displays the trip ID.
3. The HEALTH/TRIP LED on the respective Input and Output Modules indicates Red indicating a trip condition has occurred.



Resetting a Trip Condition

Before a trip can be reset, the trip condition must be removed.

Note ***A Heatsink Over-temperature trip may not reset immediately. The unit needs time to cool sufficiently.***

Using Modbus TCP

To reset a trip in Remote Mode:	
Remove the trip condition	Set Reset Fault bit True, and then return bit to False.

More than one trip can be active at any time. For example, it is possible for both the HEATSINK and the OVERVOLTAGE trips to be active. Alternatively it is possible for the inverter to trip due to an OVERCURRENT error and then for the HEATSINK trip to become active after the inverter has stopped (this may occur due to the thermal time constant of the heat sink).

Trips Table

The following trips may occur to protect the inverter. The “STATE” can be read through Modbus.

STATE	FAULT NAME	MEANING	POSSIBLE REASON FOR TRIP
0	**OK**		
1	**OVERVOLTAGE**	The Inverter internal DC link voltage is too high.	The supply voltage is too high. Failure to synchronize properly to the line
2	**UNDERVOLTAGE**	The Inverter internal DC link voltage is too low.	The supply voltage is too low. The supply voltage is missing. Grid cables too long. Possible maintenance required.
3	**OVERCURRENT**	The output current being drawn from the Inverter is too high.	Short circuit of the output. Excessive line disturbance. Possible maintenance required.
4	**HEATSINK**	The inverter heatsink is too hot.	Excessive ambient temperature. Cooling fan failure. Module assembly defect--maintenance required.
17	**MOTOR OVERTEMP**	Filter inductor temperature is too high.	Excessive load. Prolonged operation without forced cooling (check cooling fan health) Check setting of INVERT THERMIST parameter in I/O TRIPS menu. Break in filter inductor thermostat wire or defective thermostat.
24	**DESAT OVER I**	Abnormally high voltage drop across IGBT(s) due to excessive current within IGBT module	Short circuit of the output. Excessive line disturbance. Possible maintenance required.
25	**VDC RIPPLE**	Excessive DC link ripple	Defective DC supply. Poor DC supply connection.
41	**STACK TRIP**	The inverter was unable to distinguish between an overcurrent/desat or overvoltage trip	Short circuit of the output. Excessive line disturbance. Possible maintenance required.

STATE	FAULT NAME	MEANING	POSSIBLE REASON FOR TRIP
52	**FIRMWARE ERROR**	The firmware in the inverter has stopped executing	Corrupted firmware. Re-install firmware. Replace module.
63	**DRIVE CONFIG**	Missing or corrupted configuration.	Re-load configuration.
65	**CUSTOM TRIP 1 (EXERNAL WATCHDOG TIMEOUT)**	Communication over Ethernet TCP (modbus) has been lost or is not being updated.	Verify Modbus connection and ensure watchdog is serviced at least three times per second.
68	**CUSTOM TRIP 4 (ESTOP)**	External Estop circuit is not energized.	Verify 24 Volts DC is supplied to Estop (EPO) circuit.
70	**CUSTOM TRIP 6 (DC OVERVOLTAGE)**	DC bus voltage is above 840 volts dc while inverter is running.	Check health of DC supply.
71	**CUSTOM TRIP 7 (DC UNDERVOLTAGE)**	DC bus voltage is below 580 volts dc while inverter is running.	Check health of DC supply and connections.
90	**VOLTAGE MAINS LOST**	Positive and/or negative sequence values out of range.	Check health of grid connection. Adjust trip values if needed.
91	**HIGH VOLTAGE TRIP**	Grid voltage too high.	Check health of grid connection. Adjust trip values in Grid Control 2 block if needed.
92	**LOW VOLTAGE TRIP**	Grid voltage too low.	Check health of grid connection. Adjust trip values in Grid Control 2 block if needed.
93	**OVER FREQUENCY**	Grid frequency too high.	Check health of grid connection. Adjust trip values in Grid Control 3 block if needed.
94	**UNDER FREQUENCY**	Grid frequency too low.	Check health of grid connection. Adjust trip values in Grid Control 3 block if needed.
If any fault is presented on Modbus other than those listed, Contact Parker EGT Product Support			

Checksum Fail

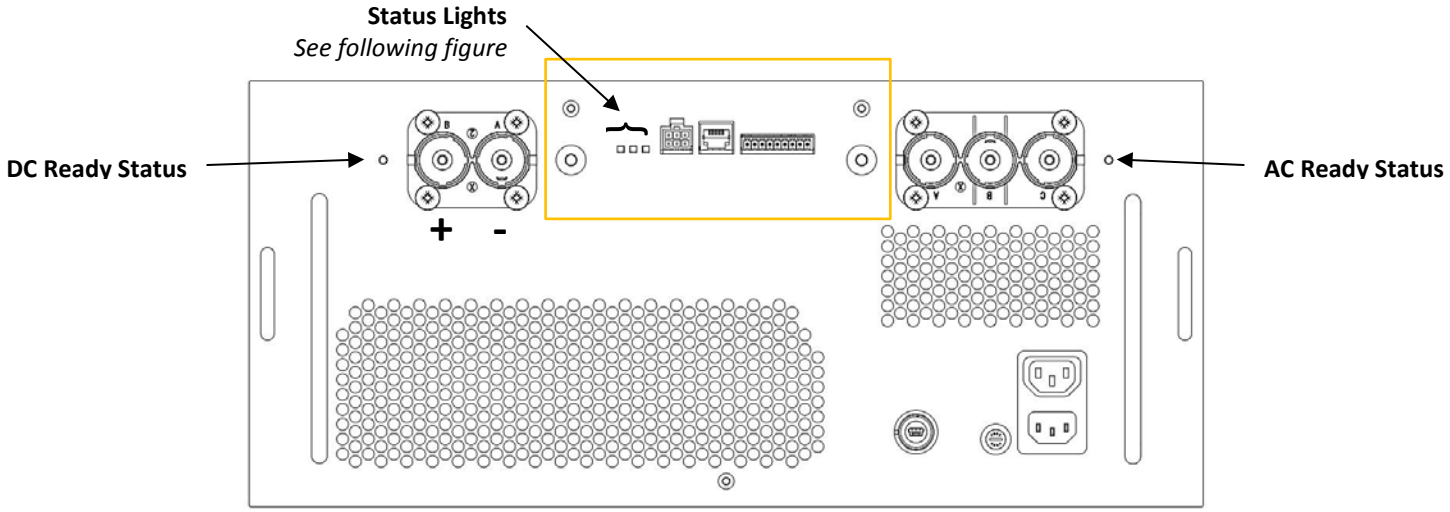
When the inverter powers-up, non-volatile memory is checked to ensure that it has not been corrupted. In the rare event of corruption being detected, the inverter will not function. If this occurs, the preferred course of action is to swap the inverter and return the failed unit to an authorized repair center. The repair center will have necessary spare parts and tools to restore the unit to working condition.

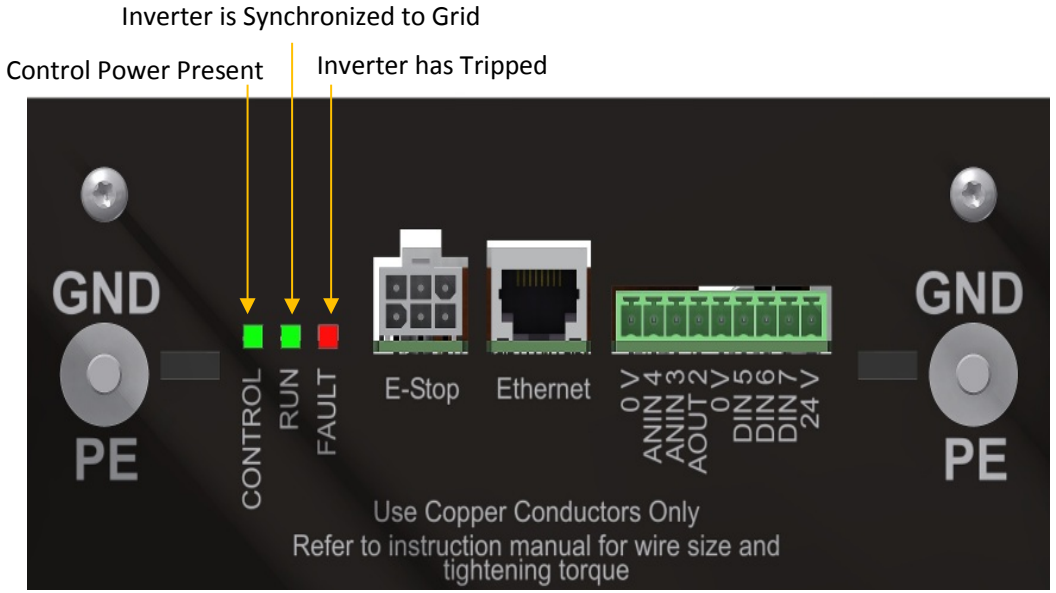
Fault Finding

Problem	Possible Cause	Remedy
Inverter will not power-up	Fuse blown	Check supply details, replace with correct fuse.
	Faulty cabling	Check all connections are correct and secure.
		Check cable continuity
Inverter fuse keeps blowing	Faulty cabling or connections wrong	Check for problem and rectify before replacing with correct fuse
	Faulty inverter	Contact Parker Hannifin EGT
Cannot obtain HEALTH state	Incorrect or no supply available	Check supply details
Inverter will not run at switch-on	Grid voltage not present	Check health of grid

Table 8-3 Fault Finding

Front Panel LEDs





	CNTRL	RUN	FAULT	DC STATUS	AC STATUS
green	control power is present	inverter enabled	-	-	-
red	-	-	inverter tripped	-	-
OFF	control power is off	inverter disabled	inverter OK	-	-
red	-	-	-	DC bus voltage present	inverter connected to grid
OFF	-	-	-	DC bus voltage off	inverter not connected to grid

Chapter 6 Routine Maintenance & Repair

This section provides general maintenance instructions. It does not provide detailed repair or diagnostic instructions.

- Cleaning Instructions
- Cleaning Instructions
- The product has generally good resistance to acids, alkalis and oils at normal temperatures. The product can be cleaned with:
- Water
- Diluted soap in water
- General purpose chlorine-free cleaners that are mildly acidic, mildly alkaline, or neutral e.g. 409(R), Lysol(R), Windex(R), etc.
- Mild solvent-free degreasers e.g. Greased-Lightning(R)

Cleaning agents should be applied to a soft cloth and wiped across the product. DO NOT spray cleaning agents directly onto the product. This will prevent chemicals from entering the enclosure. DO NOT apply cleaning agents to the exposed contacts of connectors. Doing so may harm their performance.

- Fan Maintenance & Replacement
- Reactive Maintenance
- Preventative Maintenance
- Auxiliary Power Output Fuse Replacement

WARNING:

IMPORTANT **WARNING: These servicing instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any servicing other than that specified in the operating instructions unless you are qualified to do so.**

IMPORTANT **All electrical work must be done in accordance with local, national, and/or international electrical codes by a qualified electrician.**

IMPORTANT **WARNING: Battery Strings can produce dangerous electrical voltage levels.**

IMPORTANT **WARNING: Extreme Arc Flash and Shock Hazards**

Cleaning Instructions

The product has generally good resistance to acids, alkalis and oils at normal temperatures. The product can be cleaned with:

- Water
- Diluted soap in water
- General purpose chlorine-free cleaners that are mildly acidic, mildly alkaline, or neutral e.g. 409(R), Lysol(R), Windex(R), etc.
- Mild solvent-free degreasers e.g. Greased-Lightning(R)

Cleaning agents should be applied to a soft cloth and wiped across the product. DO NOT spray cleaning agents directly onto the product. This will prevent chemicals from entering the enclosure. DO NOT apply cleaning agents to the exposed contacts of connectors. Doing so may harm their performance.

Fan Maintenance & Replacement

Reactive Maintenance

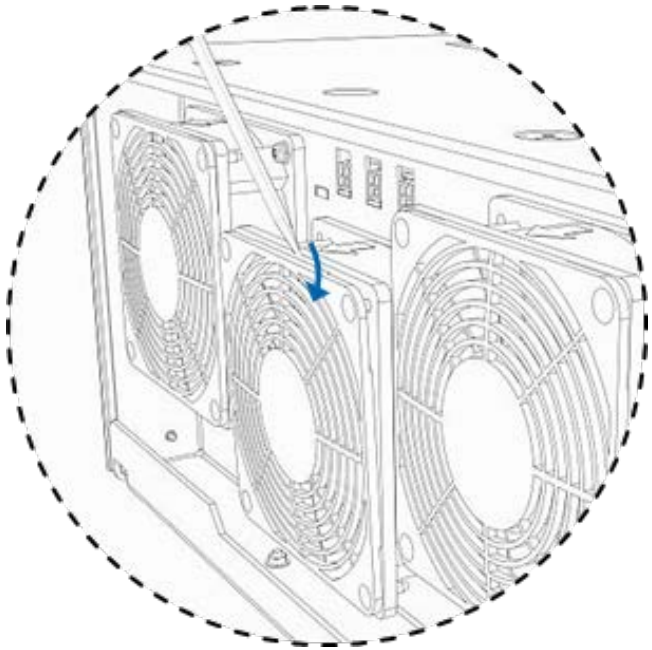
When inverter signals a fan failure warning, inspect the inverter to determine which fan has failed and replace.

Preventative Maintenance

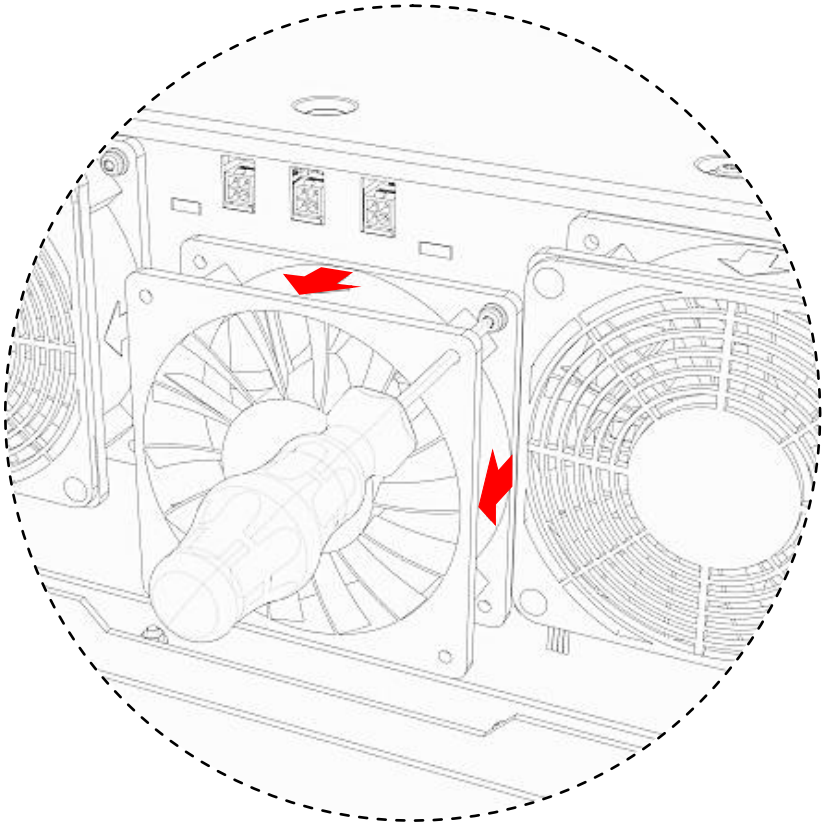
Replace all fans every 10 years in operation.

1. Disconnect the fan cables

2. Using a flat blade screwdriver remove the plastic guard to release it from the fan housing and discard.



3. Use a Torx 20 screwdriver to remove the two mounting screws

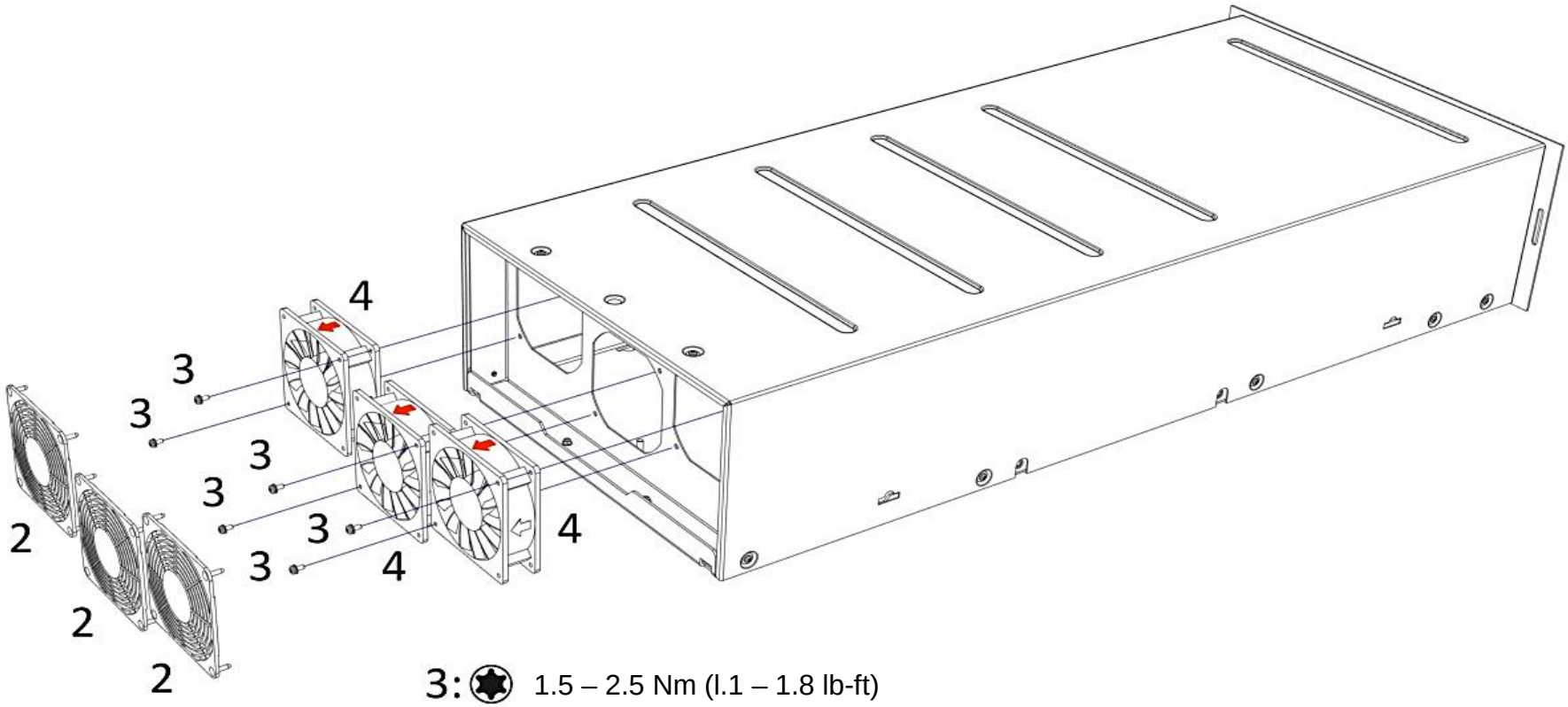


4. Remove the fan assembly and discard

5. Replace the fan assembly (LA474159U001) in the orientation shown. Ensure that the arrows are facing out away from the product.

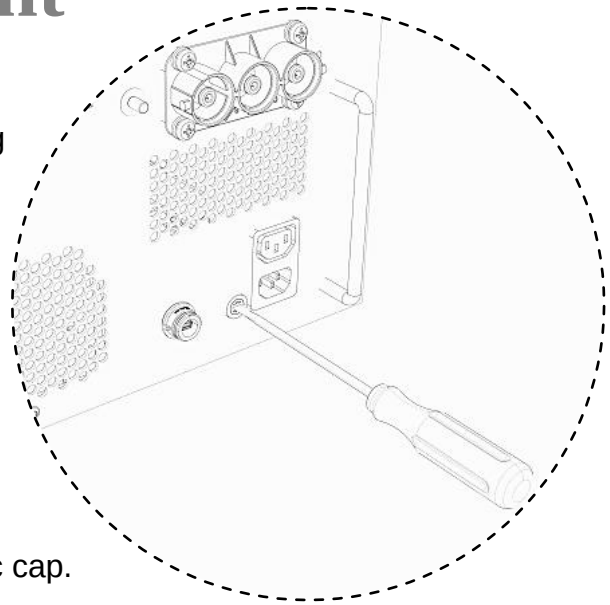
6. Re-use the mounting screws to fasten the fan assembly to the product. Torque to 1.5-2.5 Nm (1.1-1.8 lb-ft).

7. Install new plastic guard (BD465235) that is provided with replacement fans.



3: 1.5 – 2.5 Nm (l.1 – 1.8 lb-ft)

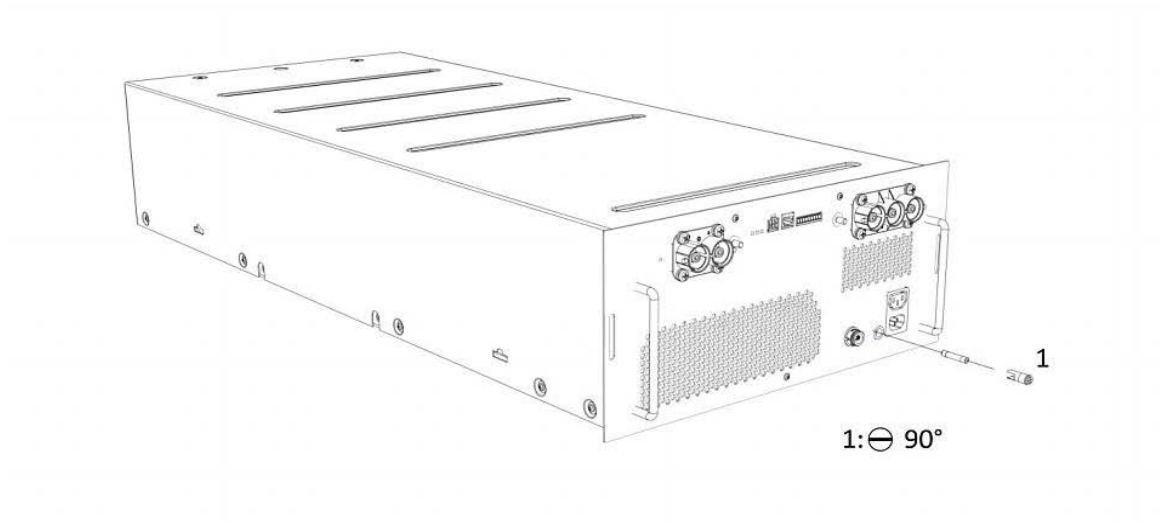
Auxiliary Power Output Fuse Replacement



1. Use a slotted screwdriver, 5 mm (3/16 in), to remove the plastic fuse cartridge by turning it 90° counter-clockwise. The fuse cartridge is spring loaded and will pop out of the housing.

2. Remove and replace the fuse (CS352658U081) in the cartridge.

3. Replace the fuse cartridge by pushing it into the housing and turning 90° clockwise. Do not overturn or over tighten as this will damage the plastic cap.



Chapter 7 PPE

This section provides general information on Personal Protective Equipment. Supervisors must assess the job tasks performed by their workers and document what personal protective equipment (PPE) is necessary for the work being performed. Each worker who is required to use PPE must be provided with training.

- OSHA PPE REGULATIONS:
- Guidelines
- Training Requirements
- Protection Requirements
- OSHA Personal Protective Equipment Policy & Procedure (1910.0132- .0136)
- Personal Protective Equipment Inspection

WARNING:

IMPORTANT **All electrical work must be done in accordance with local, national, and/or international electrical codes by a qualified electrician.**

IMPORTANT **WARNING: Battery Strings can produce dangerous electrical voltage levels.**

IMPORTANT **WARNING: Extreme Arc Flash and Shock Hazards**

- **Flash Hazard Boundary 60”**
- **Up to 24.46 Cal/cm^2 at 18”**
- **Class 3 PPE Level (Rated at 25 Cal/cm^2) – 2 layers of clothing: cotton underwear + fire resistant shirt and pants or coveralls + multilayer flash suit, VR gloves-tools, with appropriate flash hood.**
- **Limited Approach Boundary 120”**
- **Restricted Approach Boundary 12”**
- **Prohibited Approach Boundary 1”**

This section does not take the place of the specific training supervisors must provide their workers who use personal protective equipment (PPE)

Refer to the most current revision of the OSHA informational booklet OSHA 3151-12R for information on personal protective equipment (PPE).

OSHA PPE REGULATIONS:

- **1910.95 – Hearing**
- **1910.132 – General**
- **1910.133 – Eye and face**
- **1910.134 – Respirator**
- **1910.135 – Head**
- **1910.136 – Foot**
- **1910.137 – Electrical**
- **1910.138 – Hand**

Guidelines

It is important to note that engineering controls should be the primary method of establishing a safe workplace. Personal protective equipment should only be used where engineering controls are not feasible.

General Requirements

1. Supervisors must assess the job tasks performed by their workers and document what personal protective equipment (PPE) is necessary for the work being performed, document certification of hazard assessment which identifies: the workplace evaluated, the person certifying that the evaluation has been performed, and the date(s) of the hazard assessment.
2. Based on the hazards identified, the supervisor must document the appropriate level of PPE that has been selected for all appropriate workers and inform them of the PPE selection decisions.
3. The selected PPE must be fitted to appropriate workers, maintained in a sanitary and reliable condition, and used appropriately by workers as required.
4. Defective or damaged PPE must be removed from service immediately
5. Note: The OSHA standard has a non-mandatory Appendix B which contains example procedures for conducting a hazard assessment.

Training Requirements

1. Each worker who is required to use PPE must be provided with training.
2. Training on PPE must include all of the following elements: when PPE is necessary; what PPE is necessary; how to properly don, doff, adjust, and wear PPE; the limitations of the PPE; Any testing requirements (electrical PPE) ; and the proper care, maintenance, useful life and disposal of the PPE.
3. Workers must demonstrate an understanding of the training and the ability to use PPE properly before being allowed to perform work requiring the use of PPE. (Workers must be retrained when there is reason to believe that they do not have the understanding or skill to use PPE properly)
4. Retraining must be conducted whenever changes in the workplace or changes in types of PPE make previous training obsolete. NFPA 70E states that retraining is required in intervals not to exceed three years.
5. There must be written certification for each person who has received PPE training that includes the following: a statement indicating the person understood the training; the name of the person trained; the date(s) of the training; and the subject of the certification.

Protection Requirements

Head, Foot, and Hand Protection

1. Protective helmets must be used wherever there is the possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns.
2. Protective helmets must meet the American National Standard for Personnel Protection Requirements, ANSI Z89.1-1986 (Protective Headwear for Industrial Workers).
3. Protective footwear must be used wherever there is the danger of foot injuries due to falling or rolling objects, objects piercing the sole, or where feet are exposed to electrical hazards.

4. Protective footwear must meet the requirements of the American National Standard for Personal Protection--Protective Footwear, ANSI Z41-1991.
5. Appropriate protective gloves must be used wherever there is the danger to hands of exposure to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.

Eye and Face Protection

1. Workers are required to wear appropriate eye protective devices while participating or observing activities which present a potential eye safety hazard.
2. All protective eye and face devices must comply with ANSI Z87.1-1989.

Note: Regular prescription eye glasses do not meet this requirement. Goggles or other protective glasses meeting the American National Standard must be worn over-top prescription eye glasses.

Hearing Protection

1. Whenever feasible, employers are required to reduce the noise at the source through engineering solutions. When this is not possible or economically feasible it is acceptable to use hearing protection as a temporary solution. The term hearing conservation as defined by OSHA includes the following aspects, which the employer is responsible to carry out:

    A. Monitoring of the noise environment. If the TWA (Time Weighted Average) noise level is exceeding 85 dB(A), a hearing conservation program is required.

    B. Several different types of hearing protectors are required to be offered to the employees. The employees are required to use the hearing protection, and the employer is responsible for the enforcement.

C. Establishing a baseline audiogram for each noise exposed employee, and annual hearing tests thereafter in order to monitor the hearing health of the employees.

D. Take corrective action when it is concluded that a noise induced hearing damage is occurring. Corrective action can entail further education and training in the use and importance of full time use of hearing protection. Seeking the use of hearing protectors better suited to the environment and the individual.

OSHA's Permissible Noise Exposure

dB	Hours Exposure
90 dB	8.0 hours
92 dB	6.0 hours
95 dB	4.0 hours
97 dB	3.0 hours
100 dB	2.0 hours
102 dB	1.5 hours
105 dB	1.0 hours
110 dB	30 minutes
115 dB	15 minutes

Posting Requirements

1. All areas and equipment requiring the use of PPE devices shall be posted with a sign indicating this requirement.

Note: The warning signs on the enclosure should be inspected at each visit to ensure that the warning signs have not become illegible.

OSHA Personal Protective Equipment Policy & Procedure (1910.0132- .0136)

- Personal Protective Equipment, or PPE, must be provided, used, and maintained in a sanitary and reliable condition when there is a reasonable probability of injury or illness that can be prevented by such protection.

- PPE includes protection for eyes, face, head and extremities, protective clothing, respiratory devices, protective shields and barriers.

- When employees provide their own PPE, the employer is responsible to assure its adequacy.

- All personal protective equipment shall be of safe design and construction for the work to be performed. See ANSI Z133 as well as the other ANSI standards it references for details.

- The employer has to assess the workplace (including the shop) to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, the employer shall:
    1. Select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified;
    2. Communicate selection decisions to each affected employee; and,
    3. Select PPE that properly fits each affected employee.

- The employer has to verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

Personal Protective Equipment Inspection

All PPE is to be inspected prior to and after each use. If the PPE is damaged, do not use it. Damaged PPE must be replaced.

Hard Hats

- Class G (or A) helmets help protect against impact and low-voltage electrical conductors. Shells are proof-tested at 2200 volts of electrical charge.

- Class E (or B) helmets help protect against impact and high-voltage electrical conductors. Shells are proof-tested at 20,000 volts.
- Type 1 Hardhats protect against impacts to the top of the head.
- Type 2 Hardhats protect the head from top and side impacts.

INSPECTION:

- The suspension system is not excessively worn
- The straps are not torn
- The plastic components are not broken
- The helmet has not sustained damage from an impact, poor treatment, or excessive use
- The shell is not dented, cracked or broken
- The shell has not been damaged by high temperature
- The shell has not been degraded by UV light (white chalky substance on the surface of the shell)

Hearing (must be ANSI Z87 compliant).

- Ear Plugs and Ear Muffs individually protect against noise level of 28-30 dB (A).

- For greater levels of protection Ear Plugs and Ear Muffs can be worn in conjunction to protect against higher noise levels.

INSPECTION:

- The Ear plugs do not have cracks, hardening, discoloration, rips, cuts, tears, holes, or microbial growth (bad odor emanating from the Ear Plugs).

Eyewear (must be ANSI Z87 compliant)

- Safety Glasses and Goggles protect against moving particles and objects.
- Polycarbonate Face Shields protect against moving particles and objects
- Polycarbonate Face Shields with a reflective coating protect against moving particles and objects and against radiant energy (UV light and heat).
- Arc Flash Category 2 Face Shield with a reflective coating is designed to attach to a standard hardhat and protects against moving particles and objects and against radiant energy at a rating of 8 Cal/cm^2

INSPECTION:

- The eyewear does not have broken or damaged components.
- The eyewear does not have elastic straps that are excessively worn or splitting.
- The eyewear does not have lenses that are scratched or abraded in a manner that would obstruct vision.

Arc Flash Hood

- Arc Flash Hood with a Face Shield with a reflective coating and a 15” front bib fits over a standard hard hat and protect against moving particles and objects and against radiant energy at a rating of 8, 12, 20, 40 Cal/cm^2. The hood / bib material depends on the Category the Arc Flash Hood is designed to protect against and can be a combination of Indura, Nomex, Protera, RevoLite, TuffWeld and Kevlar.

INSPECTION:

- The face shield is not broken or damaged.
- The eyewear does not have elastic straps that are excessively worn or splitting.
- The face shield is not scratched or abraded in a manner that would obstruct vision.
- The material of the hood does not have burns, cracks, hardening, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the Arc Flash Hood).

Gloves

(It will be necessary to wear one type of glove over another)

- Class 00 Gloves provide protection up to 500 volts and are constructed of rubber blends.
- Class 0 Gloves provide protection up to 1000 volts and are constructed of rubber blends.
- Class 1 Gloves provide protection up to 7500 volts and are constructed of rubber blends.
- Class 2 Gloves provide protection up to 17,000 volts and are constructed of rubber blends.
- Arc Flash Fire Resistant Gloves are not electrically insulated. They are rated in Cal/cm^2 ratings of 12, 20, 36, 40, 51 Cal/cm^2. They are constructed of Indura.
- Leather gloves are not electrically insulated. They protect Electrical insulating gloves from damage due to abrasions or puncture.

INSPECTION:

- The gloves do not have cracks, hardening, discoloration, rips, cuts, tears, pin-holes or microbial growth (bad odor emanating from the glove).

Footwear (must be ANSI Z41 compliant).

- Hard Toe Boots protect against injury from falling, rolling, or lacerating objects. The hard toes are constructed of metal or acrylics. The boot material is available in leather, synthetic leather, chemical resistant material, or cut resistant materials such as Kevlar.

INSPECTION:

- The footwear does not have cracks, hardening, discoloration, rips, cuts, tears, holes, or microbial growth (bad odor emanating from the footwear).

Class 1 Nomex Class 2 Indura Underwear

Arc Flash Undergarments

- Arc Flash Undergarments are available, but not specifically required. Undergarments made of natural, non-melting fabrics are acceptable.

- Undergarments fit under clothing and protect against radiant energy at a rating of 4 - 18 Cal/cm^2. The garment material (typically Indura or Nomex) depends on the Calorie-rating. Material weight ranges from 4-8 oz.

INSPECTION:

- The material does not have burns, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the garment).

Class 1 Nomex Clothing Class 2 Indura Clothing

Arc Flash Garments

- Arc Flash garments are shirts, pants or socks that protect against radiant energy at a rating of 4-12 Cal/cm^2. The garment material (typically Indura or Nomex) depends on the Calorie-rating. Material weight ranges from 4-9 oz.

INSPECTION:

- The material does not have burns, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the garment).

Category 1 Nomex Coveralls

Category 2 Protera

Arc Flash Coveralls

- Coveralls fit over clothing and protect against radiant energy at a rating of 5.7 - 12.3 Cal/cm^2. The coverall material (typically Indura or Nomex) depends on the Calorie-rating. Material weight ranges from 4-8 oz.

INSPECTION:

- The material does not have burns, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the garment).

Category 3 Indura

Category 4 Indura Arc Flash

Category 4 Arc Flash Suit

Arc Flash Suit

- An Arc Flash Suit fits over clothing and is comprised of a coat and a pair of bibs. The Arc Flash Suit protects against radiant energy at a rating of 8-40 Cal/cm^2. The material depends on the Calorie-rating the Arc Flash Suit is designed to protect against and is typically constructed of multiple layers of a combination of Indura, Nomex, Protera, RevoLite, TuffWeld or Kevlar. Material weight ranges from 7 oz. For an 8 Cal/cm^2 Category 2 Arc Flash Suit to 13 oz. Lined with 5.5 oz. for a 40 Cal/cm^2 Category 4 Arc Flash Suit.

INSPECTION:

- The material does not have burns, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the garment).

Arc Flash Balaclava

- Arc Flash Balaclava a style of head protection worn under a standard hard hat with a goggles or a Face Shield with a reflective coating that protects against moving particles and objects and against radiant energy at a rating of 8, 12, 20, 40 Cal/cm^2. The balaclava material and number of layers depend on the Category the Arc Flash Hood is designed to protect against and can be a combination of Indura, Nomex, Protera and Kevlar.

INSPECTION:

- The material of the balaclava does not have burns, cracks, hardening, discoloration, rips, cuts, tears, holes or microbial growth (bad odor emanating from the Arc Flash Balaclava).

NOTE: NFPA 70E 2012 [Section 130.7(C)(13)(b)]: When inside the AFB and anticipated exposure is 12 cal/cm² or less, employees will now be required to wear either an arc-rated balaclava with an arc rated, wrap-around style face shield (protecting face, chin, ears, forehead and neck), or an arc-rated hood like that used in an arc flash suit. But when anticipated incident energy exposure is greater than 12 cal/cm², then an arc-rated hood will now be required.

Chapter 8 Ethernet

Objective

Set Ethernet IP address for an 890 inverter fitted with an Ethernet fieldbus option card.

Procedure

Ethernet fieldbus option card is standard on the 890GTR.

There are three options for setting the Ethernet IP address:

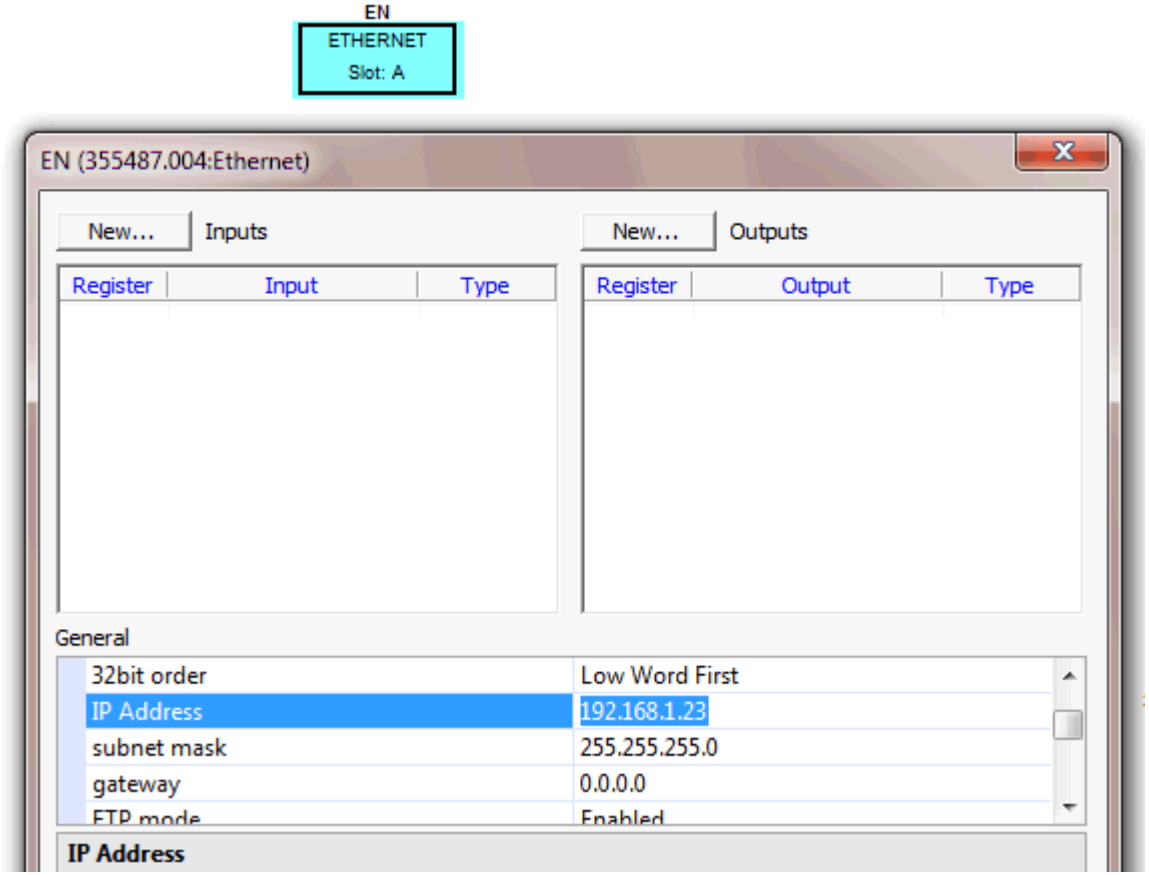
Hardcoded via the VM configuration (this is the most commonly used method). (page 8-3)

Set via **DSE**. (page 8-4)

Set via **BootP** server.(page 8-5)

Hardcoded Option (for 890 hardware)

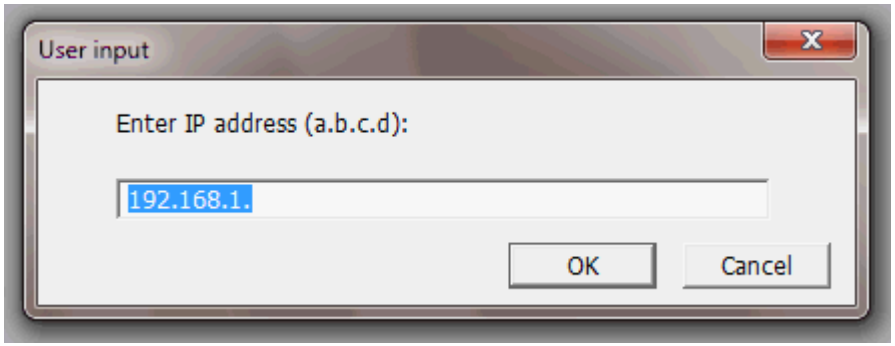
1. In the configuration insert an Ethernet function block:
2. Open the Ethernet function block and set the IP address parameter to the desired IP address.
3. You should also set the Subnet mask parameter since some versions of firmware require this in order to set the IP address. Generally, 255.255.255.0 is a good default value to use.



See the Ethernet function block help for more details.

DSE Option

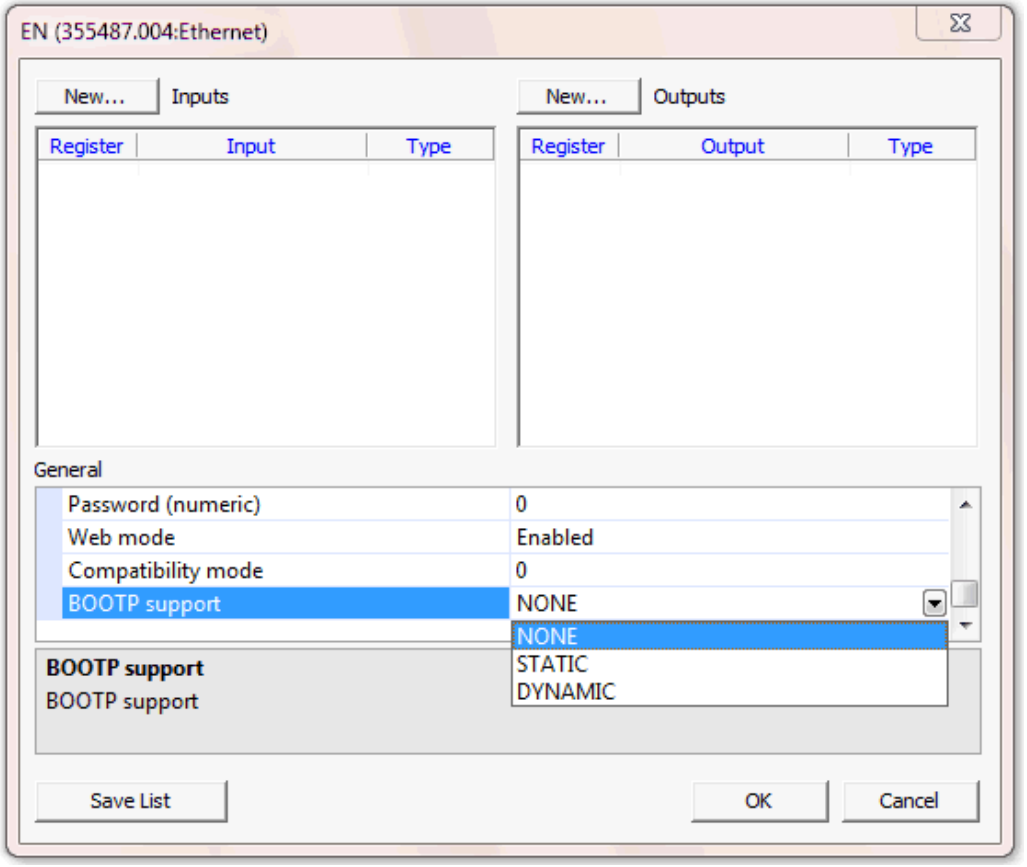
Connect to the module and select “Set IP Address…” in the “Command” menu. The following dialog should come up:



Enter the desired IP address and click on OK. Note that if you are connected to the module via the Ethernet, you may have to exit DSE and/or restart the module for DSE to connect after changing the address. This method is not supported for all versions of firmware and may be overridden by a Hardcoded address (see above) or a BootP set address (see below) when the module is re-started.

BootP Option (for 890 hardware)

BootP is not available for version 2.4, 3.12, 4.1 and 5.2 (and earlier) firmware. BootP will only be used if the Hardcoded address (see above) is 0.0.0.0 and the “BootP support” parameter in the Ethernet function block is set to “STATIC” or “DYNAMIC”:



If “BootP support” parameter is set to “STATIC”, the module will attempt to obtain an IP address via BootP whenever a configuration is installed. If an IP address is obtained from a BootP server, it is saved and used on subsequent power cycles. If “BootP support” parameter is set to “DYNAMIC”, the module will attempt to obtain an IP address via BootP whenever a configuration is installed or power is cycled.

Appendix A Inverter Keypad

The 890GTR is not equipped with a keypad. Only authorized personnel can install or use a keypad with an 890GTR. Details of keypad operation can be found in the 890GTB Grid Tie Product manual HA473578U201.

Appendix B Programming

The 890GTR Grid-Tie Inverter uses a small subset of the functionality of the AC890 control platform. This appendix highlights the functions used for grid-tie applications.

- Configure the Inverter
- Programming with Block Diagrams

Configure the Inverter

IMPORTANT: Inverters are shipped pre-configured from the factory. This section is for reference only!

An 890GTR grid-tie inverter uses a combination of native 890 function blocks and library function blocks for control. If you receive a replacement control board, you must configure it to your application. To do this, use DSELite supplied on the CD.

Configure the Inverter

The simplest method for configuring an inverter is to reinstall the original configuration using DSELite. The DSELite configuration tool has a full Help system. Insert the DSELite disk into your PC and follow the on-screen instructions.

You can use the tool to manually set-up the inverter so that it meets the requirements for your application. This involves connecting input and output terminals to desired function block parameters, creating sequencing logic, configuring communication channels, and entering desired parameter values.

This manual describes inverter functionality programmed into a standard Parker EGT grid-tie inverter.

Connecting to a PC

Connect the Grid-Tie inverter via the USB port on the front of the inverter to your PC using an approved USB lead.

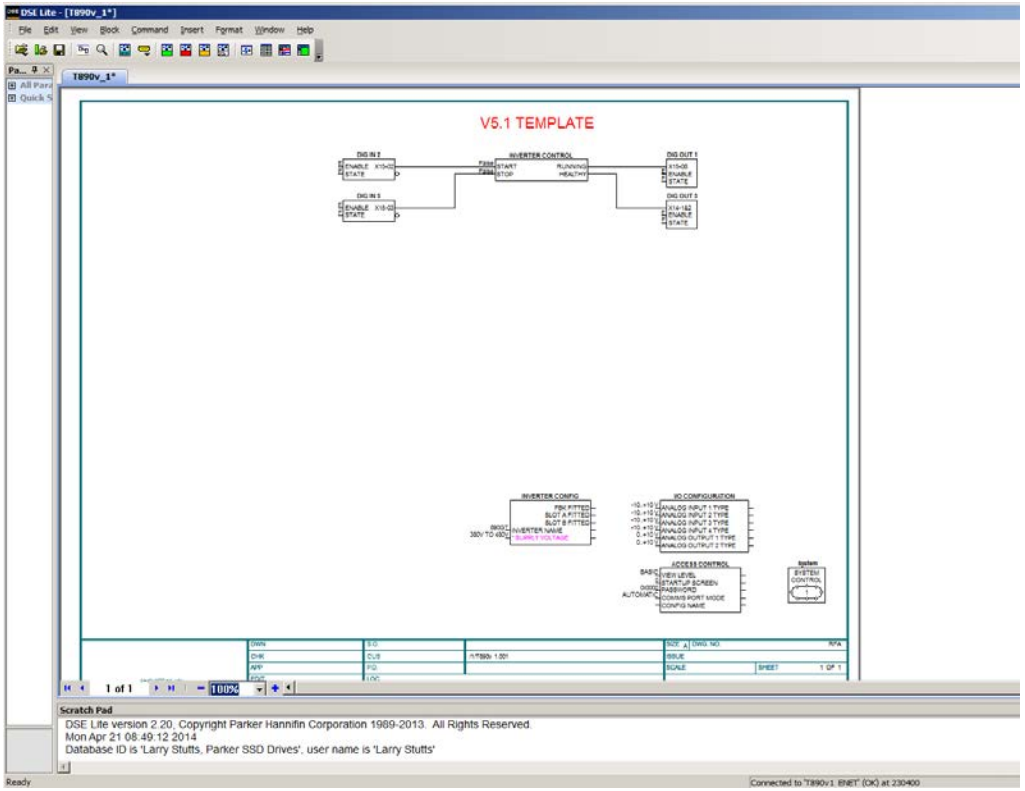
Programming with Block Diagrams

Block diagram programming provides a visual method of planning the software to suit your application. The blocks described here are those blocks used by the Shipping Configuration(s) in DSELite (the configuration shipped with your product may vary). The figure below shows a typical block diagram as seen in DSELite.

The processes performed by the shipping configuration are represented as a block diagram, consisting of *function blocks* and *links:*

- Each function block contains the parameters required for setting-up a particular processing feature. Sometimes more than one instance of a function block is provided for a feature, for example multiple digital inputs.
- Software links are used to connect the function blocks. Each link transfers the value of an output parameter to an input parameter of another (or the same) function block.

Each individual block is a processing feature; that is, it takes the input parameter, processes the information, and makes the result available as one or more output parameters.


V5.1 TEMPLATE
Scratch Pad
DSE Lite version 2.20. Copyright Parker Hannifin Corporation 1989-2013. All Rights Reserved.
Mon Apr 21 08:49:12 2014
Database ID is 'Larry Stutts, Parker SSD Drives', user name is 'Larry Stutts'

Programming Rules

The following rules apply when programming:

- Function block output parameter values cannot be changed (because they are a result of the processing in the function block).
- Function block input parameter values that receive their values from an internal link in the Block Diagram cannot be changed (as they will change back to the value they receive from the link when the inverter is running).

Function Block Descriptions

For function block descriptions, refer to Firmware Version 5.1 Manual (HA473746U001) Section 3.

Function Blocks

Page	Block	Page	Block	Page	Block	Page	Block
I/O Hardware Configuration							
3-15	ANALOG INPUT	3-18	ANALOG OUTPUT	3-24	DIGITAL INPUT	3-25	DIGITAL OUTPUT
3-15,18	I/O CONFIGURATION						
Sequencing/Referencing							
3-19	AUTO RESTART	3-46	LOCAL CONTROL	3-55	SEQUENCING LOGIC		
Inverter Control							
3-22	CURRENT LIMIT	3-31	ENERGY METER	3-32	FEEDBACKS	3-36	GRID CONTROL
3-41	INVERSE TIME	3-42	INVERTER	3-47	MPPT	3-52	PATTERN GEN
3-54	POWER LIMIT						
Communications							
3-21	COMMS CONTROL	3-34	FIELDBUS				
Trips							
3-23	CUSTOM TRIPS	3-40	I/O TRIPS	3-59	TRIPS HISTORY	3-60	TRIP STATUS
Menus							
3-14	ACCESS CONTROL	3-27	DISPLAY SCALE	3-49	OP STATION	3-50	OPERATOR MENU
3-58	SETPOINT DISPLAY						
Miscellaneous							
3-44	INVERTER CONFIG	3-30	EMC CAPACITORS				

Appendix C Compliance

- Introduction
- Europe
- Australia & New Zealand
- EMC
- EMC General Installation Considerations
- Increasing Grid Cable Length
- Certificates

Introduction

890GTR Inverters are certified as being compliant with the regulated market requirements in:

Europe

Inverters are CE certified as being compliant with

- The Low Voltage Directive 2006/95/EC
- The EMC Directive 2004/108/EC

USA

- This release of this product has NOT been certified by Underwriters Laboratory Standard UL508C for Power Conversion Equipment

Canada

- This release of this product has NOT been certified by Canadian Standards Association C22.2 No.14 for Industrial Control Equipment

Australia & New Zealand

- CTick mark indicating EMC compliance is validated by compliance with the European Harmonised Standards for EMC

Rest of the world

- Compliance may be certified for any countries where certification is based on CISPR (IEC) standards

European Compliance

CE Marking CE

The CE marking is placed upon the product by Parker Hannifin Manufacturing Ltd to facilitate its free movement within the European Economic Area (EEA). The CE marking provides a presumption of conformity to all applicable directives. Harmonized standards are used to demonstrate compliance with the essential requirements laid down in those relevant directives.

It must be remembered that there is no guarantee that combinations of compliant components will result in a compliant system. This means that compliance to harmonised standards will have to be demonstrated for the system as a whole to ensure compliance with the directive.

Local wiring regulations always take precedence.

Where there are any conflicts between regulatory standards for example earthing requirements for electromagnetic compatibility, safety shall always take precedence.

Low Voltage Directive

When installed in accordance with this manual the product will comply with the low voltage directive 2006/95/EC.

Protective Earth (PE) Connections

Only one protective earth ⏚ conductor is permitted at each protective earth terminal contacting point.

The product requires a protective earth conductor cross section of at least 10mm^2

Compliance with harmonised standards provides a "presumption of conformity" and is the route which has been adopted by Parker Hannifin Manufacturing Limited certification (DoC) is supported by tests undertaken in accordance with harmonised standard BS EN50178:1998.

EMC Directive

When installed in accordance with this manual the product will comply with the electromagnet compatibility directive 2004/108/EC.

The following information is provided to maximise the Electro Magnetic Compatibility (EMC) of systems in their intended operating environment, by minimising their emissions and maximising their immunity.

EMC Compliance

WARNING
In a domestic environment, this product may cause radio interference, in which case supplementary mitigation measures may be required.

Definitions

Category C1

PDS (Power Drive System) of rated voltage less than 1000V, intended for use in the first environment

Category C2

PDS (Power Drive System) of rated voltage less than 1000V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional.

Note: A professional is a person or an organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

Category C3

PDS (Power Drive System) of rated voltage less than 1000V, intended for use in the second environment and not intended for use in the first environment.

Category C4

PDS (Power Drive System) of rated voltage equal to or above 1000V, or rated current equal to or above 400A, or intended for use in complex systems in the second environment.

First Environment

Environment that include domestic premises, it also includes establishments directly connected without transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.

Note: Houses, apartments, commercial premises or offices in a residential building are examples of first environment locations.

Second Environment

Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Note: Industrial areas, technical areas of any building fed from a dedicated transformer are examples of second environment locations.

The 890GTR is generally a category C3 apparatus. Some of the equipment with higher ratings might be classified in Category C4; but for certification, and as an aid to builders of complex system, the emission limits and immunity levels associated with category C3 have been applied.

Parker Hannifin Manufacturing Limited certification (DoC) is supported by tests undertaken in accordance with harmonised standard BS EN61800-3.

Australia & New Zealand

A Mutual Recognition Agreement in relation to conformity assessment, certificates and markings between Australia and the European Community was signed on June 1, 1998 and entered into force on January 1, 1999. Sectoral Annexes of the MRA cover: medicinal products, medical devices, telecommunications terminal equipment, low voltage equipment (i.e. electrical safety), electromagnetic compatibility (EMC), machinery, pressure equipment and automotive products.

EMC Standards

Extract from Mandatory Australian Communications Authority standards.

Product	European	International	AS/NZS
Industrial, scientific, and medical (ISM) equipment	EN 55011	CISPR 11	2064 Note 3
Information technology equipment	EN 55022	CISPR 22	3548 Note 2
Generic (residential, commercial, and light industry)	EN 50081.1	IEC 61000-6-3	4251.1
Generic (industrial environments)	EN 50081-2	IEC 61000-6-4	4251.2
Adjustable speed electrical power drive systems	EN 61800-3	IEC 61800-3	0

Parker Hannifin Manufacturing Limited certification (DoC) is supported by tests undertaken in accordance with harmonised standard BS EN61800-3.

EMC

Emissions Limits

Conducted

Frequency (MHz)	DB (µV)		Product Specific
	Quasi Peak	Average	EN 61800-3
where I ≤100A 0.15 - 0.5 0.5 - 5.0 5.0 - 30.0 *decreasing with log of frequency to:*	100 86 90 70	90 76 80 60	Category C3 Table 17
where I ≥100A 0.15 - 0.5 0.5 - 5.0 5.0 - 30.0	130 125 115	120 115 105	

Where these levels are too high and to ensure compatibility with other equipment, EMC filters are available from Parker.

Radiated

Frequency (MHz)	DB (µV)	Product Specific
	Quasi Peak	EN 61800-3
30≤ f- ≤230 230≤ f- ≤1000	50 60	Category C3 (Table 18) Measured at 10m

Where these levels are too high and to ensure compatibility with other equipment, Parker can advise on suitable counter-measures.

EMC Immunity Levels

Port	Phenomenon	Basic standard for test method	Level	Performance (acceptance criterion)
Enclosure port	ESD	IEC 61000-4-2	4 kV CD or 8 kV AD if CD impossible	B
	Radio-frequency electromagnetic field, amplitude modulated.	IEC 61000-4-3 see also 5.3.4	80 MHz to 1000 Mhz 10 V/m 80% AM (1 kHz)	A
Power ports	Fast transient-burst	IEC 61000-4-4	2 kV/5 kHz [a]	B
	Surge [b] 1,2/50 µs, 8/20 µs	IEC 61000-4-5	1 kV [c] 2 kV [d]	B
	Conducted radio-frequency common mode [e]	IEC 61000-4-6 see also 5.3.4	0,15 MHz to 80 MHz 10 V 80 % AM (1 kHz)	A
Power interfaces	Fast transient-burst [e]	IEC 61000-4-4	2 kV/5 kHz Capacitive clamp	B
Signal interfaces	Fast transient-burst [e]	IEC 61000-4-4	1 kV/5 kHz Capacitive clamp	B
	Conducted radio-frequency common mode [e]	IEC 61000-4-6 see also 5.3.4	0,15 MHz to 80 MHz 10 V 80 % AM (1 kHz)	A
Ports for process measurement control lines	Fast transient-burst [e]	IEC 61000-4-4	2 kV/5 kHz Capacitive clamp	B
	Surge [f] 1,2/50 µs, 8/20 µs	IEC 61000-4-5	1 kV [d,f]	B
	Conducted radio-frequency common mode [e]	IEC 61000-4-6 see also 5.3.4	0,15 MHz to 80 MHz 10 V 80 % AM (1 kHz)	A

CD : contact discharge AD : air dischargeAM : amplitude modulation

a Power ports with current rating < 100 A: direct coupling using the coupling and decoupling network. Power ports with current rating ≥ 100 A: direct coupling or capacitive clamp without decoupling network. If the capacitive clamp is used, the test level shall be 4 kV/2,5 kHz.

b Applicable only to power ports with current consumption , 63 A during light load test conditions as specified in 5.1.3. The rated impulse voltage of the basic insulation shall not be exceeded (see IEC 60664-1).

c Coupling line-to-line.

d Coupling line-to-earth.

e Applicable only to ports or interfaces with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

f Applicable only to ports with cables whose total length according to the manufacturer's functional specification may exceed 30 m. In the case of a shielded cable, a direct coupling to the shield is applied. This immunity requirement does not apply to fieldbus or other signal interfaces where the use of surge protection devices is not practical for technical reasons. The test is not required where normal functioning cannot be achieved because of the impact of the coupling/decoupling network on the equipment under test (EUT).

Minimum immunity requirements for PDSs intended for use in the second environment

890GTR EMC Compliance

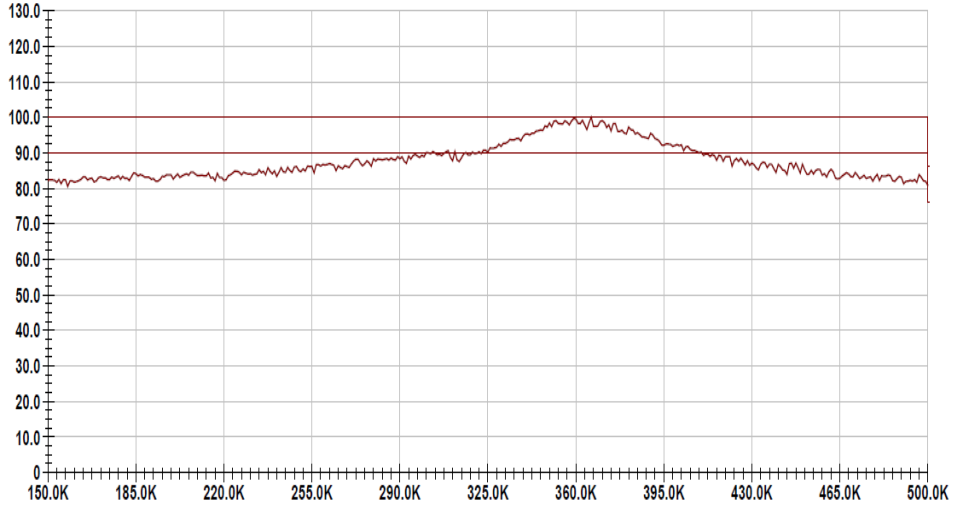
- **Ethernet cable:**
  Cat 5 shielded, maximum recommended length of 100 meters. EMC testing requires ferrite for radiated immunity

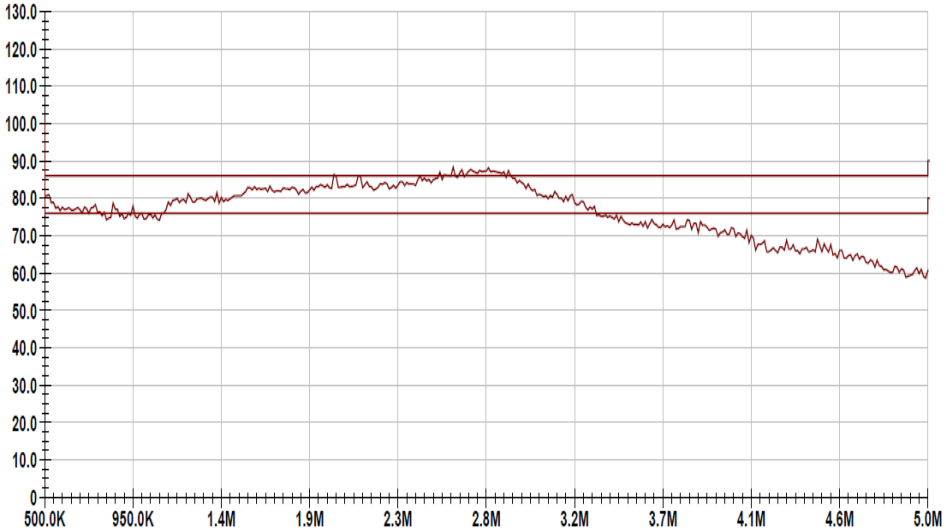
- **Estop/HVIL cable:**
  24Vdc signal used to pull in main contactor pilot relay. Shielding not required. Maximum recommended length 30 meters.

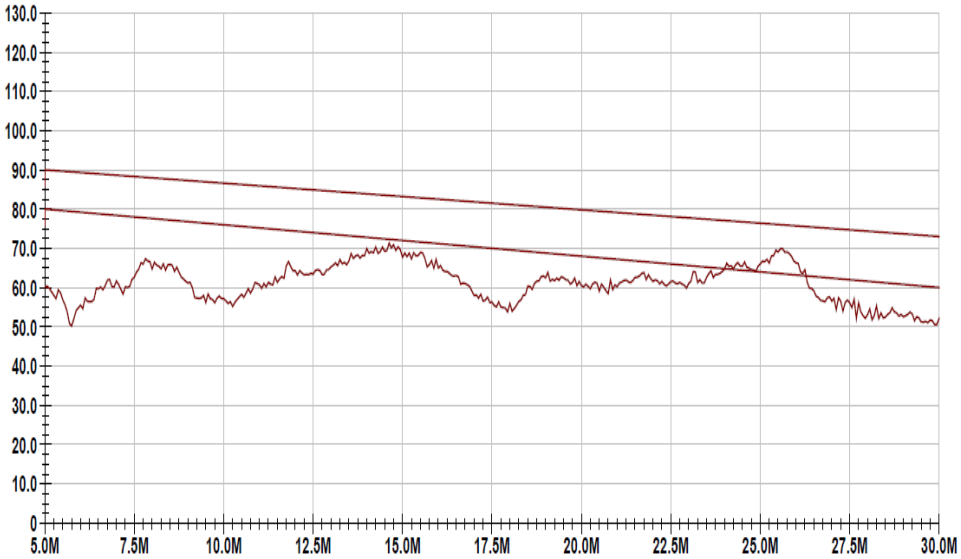
- **DC power cables:**
  Typical installation length of 1 meter. Shielding not required. Maximum recommended length of 5 meters.

- **AC power cables:**
  Shielding not required. Maximum recommended length of 30 meters.

Conducted Emissions Profile (Unfiltered Product)




130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
500.0K
950.0K
1.4M
1.9M
2.3M
2.8M
3.2M
3.7M
4.1M
4.6M
5.0M


130.0
120.0
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70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
5.0M
7.5M
10.0M
12.5M
15.0M
17.5M
20.0M
22.5M
25.0M
27.5M
30.0M

Harmonic Information

Supply Harmonic Analysis (890 GTR) Nominal frequency = 60/50 Hz, Fundamental primary current = 128 Arms

Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)	Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)
60	1	130.9	100.0	50	1	131.4	100.0
120	2	0.4	0.3	100	2	0.4	0.3
180	3	0.3	0.2	150	3	0.4	0.3
240	4	0.2	0.1	200	4	0.2	0.1
300	5	0.9	0.7	250	5	0.5	0.4
360	6	0.1	0.0	300	6	0.2	0.1
420	7	0.5	0.4	350	7	0.5	0.4
480	8	0.0	0.0	400	8	0.1	0.0
540	9	0.2	0.2	450	9	0.1	0.0
600	10	0.1	0.0	500	10	0.1	0.1
660	11	0.4	0.3	550	11	0.1	0.1
720	12	0.0	0.0	600	12	0.1	0.1
780	13	0.2	0.1	650	13	0.2	0.1
840	14	0.1	0.1	700	14	0.1	0.0
900	15	0.2	0.1	750	15	0.1	0.1
960	16	0.0	0.0	800	16	0.1	0.0
1020	17	0.3	0.3	850	17	0.1	0.1
1080	18	0.0	0.0	900	18	0.1	0.0
1140	19	0.2	0.2	950	19	0.1	0.1
1200	20	0.0	0.0	1000	20	0.1	0.1
1260	21	0.1	0.1	1050	21	0.1	0.1
1320	22	0.1	0.1	1100	22	0.1	0.1
1380	23	0.1	0.1	1150	23	0.2	0.1
1440	24	0.1	0.0	1200	24	0.1	0.1
1500	25	0.1	0.1	1250	25	0.2	0.1
1560	26	0.1	0.1	1300	26	0.1	0.0
1620	27	0.3	0.2	1350	27	0.0	0.0
1680	28	0.3	0.2	1400	28	0.1	0.1
1740	29	1.3	1.0	1450	29	0.3	0.2
1800	30	0.1	0.1	1500	30	0.1	0.1
1860	31	0.2	0.2	1550	31	0.5	0.4
1920	32	0.1	0.1	1600	32	0.1	0.1
1980	33	0.0	0.0	1650	33	0.1	0.1
2040	34	0.0	0.0	1700	34	1.6	1.2
2100	35	0.1	0.1	1750	35	1.3	1.0
2160	36	0.0	0.0	1800	36	0.0	0.0
2220	37	0.1	0.0	1850	37	0.3	0.2
2280	38	0.0	0.0	1900	38	0.1	0.0
2340	39	0.0	0.0	1950	39	0.0	0.0
2400	40	0.0	0.0	2000	40	0.1	0.1
2460	41	0.0	0.0	2050	41	0.1	0.1
2520	42	0.0	0.0	2100	42	0.0	0.0
2580	43	0.0	0.0	2150	43	0.0	0.0
2640	44	0.0	0.0	2200	44	0.0	0.0
2700	45	0.0	0.0	2250	45	0.0	0.0
2760	46	0.0	0.0	2300	46	0.0	0.0
2820	47	0.0	0.0	2350	47	0.0	0.0
2880	48	0.0	0.0	2400	48	0.1	0.0
2940	49	0.0	0.0	2450	49	0.0	0.0
3000	50	0.0	0.0	2500	50	0.0	0.0
total	--	**130.88**	**1.48**	**total**	--	**131.44**	**1.80**

EMC General Installation Considerations

Earthing Requirements

IMPORTANT **Protective earthing always takes precedence over EMC screening.**

Protective Earth (PE) Connections

Note ***In accordance with installations to EN60204, only one protective earth conductor is permitted at each protective earth terminal contacting point.***

Local wiring regulations take precedence and may require the protective earth connection of the transformer to be connected locally, i.e. not as specified in these instructions. This will not cause shielding problems because of the relatively high RF impedance of the local earth connection.

EMC Earth Connections

For compliance with EMC requirements, we recommend that the “0V/signal ground” be separately earthed. When a number of units are used in a system, these terminals should be connected together at a single, local earthing point.

Control and signal cables for the encoder, all analogue inputs, and communications require screening with the screen connected only at the inverter end. However, if high frequency noise is still a problem, earth the screen at the non-VSD end via a 0.1µF capacitor.

Note ***Connect the screen (at the VSD end) to the VSD protective earth point, and not to the control board terminals.***

Cabling Requirements

Planning Cable Runs

- Use the shortest possible grid cable lengths.
- Keep electrically noisy and sensitive cables apart.
- Keep electrically noisy and sensitive parallel cable runs to a minimum. Separate parallel cable runs by at least 0.25 metres. For runs longer than 10 metres, separation should be increased proportionally. For example if the parallel runs were 50m, then the separation would be (50/10) x 0.25m = 1.25m.
- Sensitive cables should cross noisy cables at 90°.
- Never run sensitive cables close or parallel to the grid or dc link conductors for any distance.

- Never run supply, dc link or grid cables in the same bundle as the signal/control and feedback cables, even if they are screened.
- Ensure EMC filter input and output cables are separately routed and do not couple across the filter.

Increasing Grid Cable Length

Because cable capacitance and hence conducted emissions increase with grid cable length, conformance to EMC limits is only guaranteed with the specified ac supply filter option up to a maximum cable length as specified in Appendix E: “Technical Specifications".

This maximum cable length can be improved using the specified external input or output filters.

Screened/armoured cable has significant capacitance between the conductors and screen, which increases linearly with cable length (typically 200pF/m but varies with cable type and current rating).

Long cable lengths may have the following undesirable effects:

- **Tripping on `overcurrent’ as the cable capacitance is charged and discharged at the switching frequency.**
- **Producing increased conducted emissions that degrade the performance of the EMC filter due to saturation.**
- **Causing RCDs (Residual Current Devices) to trip due to increased high frequency earth current.**
- **Producing increased heating inside the EMC ac supply filter from the increased conducted emissions.**

These effects can be overcome by adding chokes or output filters at the output of the VSD.

Mitigating Radiated Emissions

Equipment Placement

Do not place magnetic/electric field sensitive equipment within 0.25 meters of the following parts of the 890GTR system:

- **890GTR**
- **Input or output chokes/transformers**
- **The cable between 890GTR and Batteries (even when screened/armored)**
- **DC link connections (even when screened/armored)**
- **Relays and contactors (even when suppressed)**

Appendix D Associated Equipment

- General wiring and circuit protection
- Isolation transformer
- DC supply
- Uninterruptable Power Supply (UPS)
- AC Disconnect
- System ground fault detection
- Ethernet connection:

****WARNING: Parker Inverters must be installed using wiring methods according to the requirements of ANSI/NFPA 70, Canadian Electrical Code Part I, or other appropriate local or national electrical codes. It is the responsibility of the installer to ensure installation is designed and performed in compliance with these standards.**

****Danger: The 890GTR has multiple sources of power that must be disconnected before servicing. Failure to remove all power and ensure the unit is safe to approach could result in serious injury or death.**

****Danger: It is the responsibility of the site installer and site operator to determine arc flash risk levels and ensure safety procedures are put into place and followed. Failure to set up and follow safety procedures could result in serious injury or death.**

General wiring and circuit protection

Wiring codes typically require conductors and overload devices to be sized at least 125% of the continuous full load current rating of the device. The 890GTR has a maximum full load continuous current rating of 128 A (rms) on the AC grid side. The maximum full load current on the DC side is 160 A (dc). Additionally, the unit is capable of 150% overload for 1 minute, therefore any circuit protection should accommodate this overload period without issue.

Isolation transformer

The 890GTR requires a three phase isolation transformer between the AC grid and its output. This transformer should step down the grid voltage to 400 V. The transformer should have a minimum K-factor of 4. An un-bonded delta winding configuration is recommended on the inverter side of the transformer. Multiple 890GTR units can be connected to the same transformer winding provided the DC supply for each 890GTR is floating (not bonded to ground). If the DC supplies are grounded, then each 890GTR must be connected on a separate un-bonded isolated transformer winding. Grounding of both the AC and DC supplies can result in catastrophic damage to the invertor(s).

DC supply

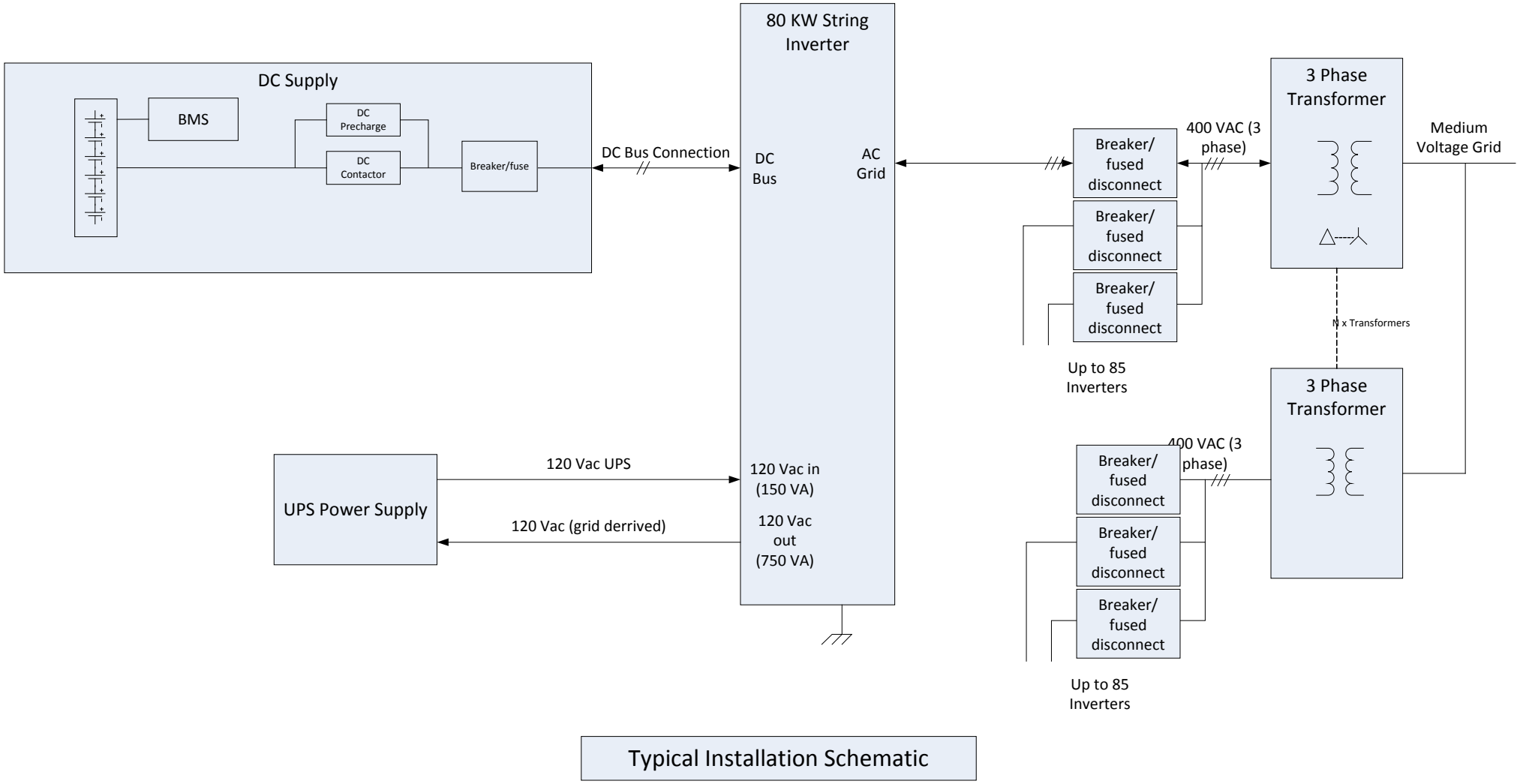
The DC bus capacitors inside the 890GTR must be pre-charged to the DC supply voltage before the DC supply can be applied. Failure to properly pre-charge the 890GTR could result in damage to the inverter or associated equipment. DC Overload and short circuit protection must be provided external to the 890GTR. The DC supply must also have a means of disconnecting during intended shutdown and fault events. Most battery systems require a Battery Management System (BMS). The BMS must be capable of operation with common-mode voltage swings of up to 1200 volts.

Uninterruptable Power Supply (UPS)

Blackstart or low voltage ride through events require that a UPS provide control power for the 890GTR. This UPS must be capable of supplying 150 VA (120 W) for each 890GTR. The 890GTR provides 120 Vac output that is generated by a 750 VA control transformer connected to grid power. This 120 V output is intended to supply power to the UPS or other associated equipment.

AC Disconnect

A grid disconnect is required. This disconnect is usually incorporated with either the AC breaker or fuse assembly.



Typical Installation Schematic

System ground fault detection

Ground fault detection can be implemented using a third party leakage resistance device. Typical installation requires both AC and DC connections to remain floating. Typical leakage resistance to ground is approximately 1.6 Meg Ohms for one 890GTR. Multiple 890GTR units on the same transformer winding will lower this resistance.

$R_{total} = R_{unit} / \#units$

Ethernet connection

Control of the 890GTR is effected through a Ethernet based LAN. Connection to this LAN is using standard Cat5 Ethernet cable with shield.

See Chapter 8 Ethernet.

Appendix E Technical Specifications

- DSE Lite Configuration Tool
- Understanding the Product Code
- Analog Input / Output Table
- Analog Input / Output Details
- Digital Input Details
- Digital Output Details
- Relay Output Details
- Reference Output Details
- User 24V Output Details
- Earthing/Safety Details
- Changing Voltage and Frequency Fault Trip Levels and Times
- Transformer Harmonics

DSE Lite Configuration Tool

Refer to DSE Lite User Manual: HA471486U001_04.pdf

Connection: section 1

Configuration: section 2

Firmware: Section 6 **(Should only be used by Parker EGT or suitably qualified personnel)**

Chart Recording: Section 4

IP Address: 192.168.1.100

Inverter Specifications

Input Data: (DC Energy Storage Interface)		
Operating Voltage range	600V – 825V DC	
Nominal DC Current	122A	At rated power
Max DC current	228A	Peak Overload Current
DC Fuse	250A, Positive leg	> 30kA Interrupt
DC Disconnection Method	None	External pre-charge and disconnect device required
Output Data: (Grid Interface)		
AC Output Configuration	3 phase, 3 wire ungrounded	
AC Output Voltage	400Vac +/- 5%	
Rated AC output VA	88.6 kVA @ +30 °C Max	At nominal voltage
Overload AC output VA	132.9kVA @ +30 °C Max	1 minute overload at nominal voltage
Grid Frequency	50/60Hz, ±5%	
Nom. AC Current	128 A	
Current harmonic distortion (TDD) %	< 3%	
AC Disconnects	1 AC Contactor	
Auxiliary Power:		
Auxiliary Power Output	120Vac, 750VA	
Internal Auxiliary Power	120Vac, 120W	At 0.6 power factor
Local User Interface:		
Comms Ports	USB, Modbus TCP CAT 5, 2 Analog Inputs, 1 Analog Output, 3 Digital Inputs	
LED Indication	DC Ready AC Ready Control Power Present Run Health	
Remote Interface:		
Remote Comm.	Modbus TCP	Other options available

E-4 Technical Specifications

Inverter Interlock		
24V Interlock	Included	
DC Connector HVIL	Included	
AC Connector HVIL	Included	
ES Interlock Input	Included	
Protections:		
Ground Fault protection	External Protection Required	
Environmental:		
Ambient temp. range, operating	10 °C to 40 °C	Derating above 30 °C
Storage temp. range	0 °C to 40 °C	
Relative humidity	15 to 95 %	Non-condensing
Altitude	1000m	Up to 15 % derating at 2000m
Seismic	Occupancy Category II Importance Factor 1.0	Site Class D, Seismic Design Category E
Enclosure Size & Weight:		
Installation	5U 19” Rack per EIA-310	Lifting Hook Provisions
Size	483 x 1054 x 215	W x D x H (mm) not including handles
Weight	91kg	
Enclosure Ingress Protection	IP21	
Standard’s Compliance:		
EMC	EN61800-3	
Harmonics	IEEE 1547	
Cabinet Protection Rating	EN 60529 IP21	
UL	UL1741	
CE	2006/95/EC LVD, 2004/108/EC EMC	

Understanding the Product Code

Each unit is identified using an alphanumeric code which records how the unit was configured when dispatched from the factory. Each block of the Model Number is identified as below using a 4 block code.

Example Product Code: 890GT R - 088 6 - 00 C U 0 - 0 4 0 0 S 0 0

Application:	Rack Mount Inverter	**R**
Power Rating:	400Vac 88kVA, 600V-825Vdc	**088**
Frequency:	50 Hz	**5**
	60 Hz	**6**
DC Connection:	Direct Connection, 250A DC Fuse	**00**
AC Connection	Contactor	**C**
Ground	Ungrounded w/o GF Detector	**U**
Enclosure	IP21 19" Rack, 5U, 42" depth	**0**
Power Meter	None	**0**
Communications	None	0
	Modbus TCP - Cu	4
Aux Power	750VA 120V output, 120V 200VA input	**0**
Build Standard	Standard	**0**
Temperature	Standard (-10C to 40C)	S
Advanced Controls & I/O	Standard	**0**
	Standard w/analog P/Q	**1**
	Dynamic controls	**2**
	Custom	**9**
Other	Standard	0
	Custom	1

Analog Input / Output Table

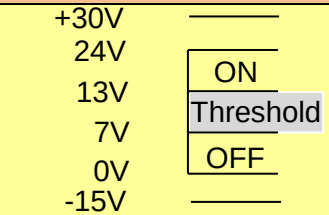
Connector Name	Connector Number	Pin Number	Signal Name	Signal Description	Input/ Output	Rated Voltage	Rated Current
AC Power Connector	A1	1	Phase U	380Vac - 420Vac, ungrounded	I/O	380Vac-420Vac	128A continuous, 192A 60 sec overload
	A1	2	Phase V	380Vac - 420Vac, ungrounded	I/O	380Vac-420Vac	128A continuous, 192A 60 sec overload
	A1	3	Phase W	380Vac - 420Vac, ungrounded	I/O	380Vac-420Vac	128A continuous, 192A 60 sec overload
DC Power Connector	B1	1	DC -	Negative DC input from energy storage source, ungrounded	I/O	600Vdc-825Vdc	155A continuous, 230A 60 sec overload
	B1	2	DC +	Positive DC input from energy storage source, ungrounded	I/O	600Vdc-825Vdc	155A continuous, 230A 60 sec overload
Auxiliary Power In	E1	C14 Connector	Control Power Input	120V 50/60Hz Input, C14 connector	Input	120Vac Nominal	1.67A Max
Auxiliary Power Out	E2	C13 Connector	Auxiliary Power Output	120V 50/60Hz Output, C13 Connector	Output	120Vac Nominal	6.25A Max
Ground Stud 1	G1	1	Ground	Earth Ground Connection, DC feed	Input	0V	4AWG Minimum conductor size
Ground Stud 2	G2	1	Ground	Earth Ground Connection, AC feed	Input	0V	6AWG Minimum conductor size
Comms Port	J1	RJ45	Modbus TCP	Ethernet connection for Modbus TCP communications to SCADA	I/O	Ethernet	Ethernet
HVIL and Emergency Stop	J2	1	E-Stop In	24V E-stop / HVIL power input	Input	24V	10mA
	J2	2	E-Stop In	Internally wired to Pin 3	Input	24V	10mA
	J2	3	E-Stop / HVIL Out	Internally wired to Pin 2	Output	24V	10mA

Connector Name	Connector Number	Pin Number	Signal Name	Signal Description	Input/ Output	Rated Voltage	Rated Current
	J2	4	E-Stop / HVIL Out	HVIL Status Output	Output	24V	10mA
	J2	5	Enable In	Contactor Enable Input	Input	24V	10mA
	J2	6	E-stop / HVIL Return	Contactor Enable / HVIL Common/ Return	Input	0V	10mA
Discrete I/O	J3	1	0V	Analog Signal Common	Output	0V	60mA
	J3	2	ANIN 4	Analog Input	Input	0V-10V or +/- 10V oR 4-20mA	4-20mA
	J3	3	ANIN 3	Analog Input	Input	0V-10V or +/- 10V oR 4-20mA	4-20mA
	J3	4	AOUT 2	Analog Output	Output	0V-10V or +/- 10V oR 4-20mA	4-20mA
	J3	5	0V	24V supply Return / Common	Output	0V	160mA
	J3	6	DIN 5	Digital input	Input	24V	7.3mA
	J3	7	DIN 6	Digital input	Input	24V	7.3mA
	J3	8	DIN 7	Digital input	Input	24V	7.3mA
	J3	9	24 V	Output 24V supply for DIN signals	Output	18V - 26V	160mA
Programming Port	P1	Mini-USB	Programming Port	Configuration, troubleshooting, or firwmare update	I/O	Mini-USB	Mini-USB
Auxiliary Power Output Fuse	FS1	1	Aux supply Output Fuse	8A Fuse to protect auxiliary output power transformer	Output	250Vac	8A
Status Lights	LED 1	N/A	Control	24V Control power present inside the module	Output	N/A	N/A
	LED 2	N/A	Run	The inverter is synchronized to the grid	Output	N/A	N/A
	LED 3	N/A	Fault	The inverter has a fault	Output	N/A	N/A
DC Ready Status Light	Light Pipe 1	N/A	DC Ready	DC voltage is sufficient to run	Output	N/A	N/A
AC Ready Status Light	Light Pipe 2	N/A	AC Ready	AC contactor is closed and the grid is present	Output	N/A	N/A

Analog Input / Output Details

Grid-Tie Inverter Analog Inputs/Outputs **AIN1 – AIN4, AOUT1 – AOUT2**		
	Inputs	Outputs
Range	0-10V, ±10V, 0-20mA, or 4-20mA (Range set in software), Absolute maximum input voltage -15V to +30V	0-10V, ±10V (10mA maximum), (Range set in software)
Impedance	Voltage Range = 47kΩ Current range = 150Ω + series diode	Voltage Range = 100Ω
Resolution	12 bit plus sign	12 bit plus sign
Sample Rate	5ms (one selected input can be 1 ms)	5ms

Digital Input Details

Grid-Tie Inverter Digital Inputs **DIN1 – DIN9, Conforming to IEC1131-2**		
Nominal Rated Voltage	24V DC	
Absolute Maximum Input Voltage	-15V to +30V	
Input Threshold	-15V to +30V	
Input Hysteresis	No	
Sample Rate	1 ms	
Input Current	7.3mA ±10% @ 24V	

Digital Output Details

Grid-Tie Inverter Digital Outputs **There are six digital outputs. Two are current sourcing outputs, DINOUT1 and DINOUT2.** **The third is a pair of volt-free relay contacts, DOUT3A and DOUT3B**	
DINOUT1, DINOUT2	
Output High Voltage	≥18V, ≤ 26V, On state, output current = 0 to maximum output currnet
Maximum Output Current	≥160mA Note: the maximum output current is the sum of all 24V sourced outputs, i.e. $i_{DINOUT1} + i_{DINOUT2} + i_{24V\ USER} \leq 160mA$
Overload/Short Circuit Protection	Indefinite
DOUT3A, DOUT3B	
Rated Voltage	24V DC SELV
Rated Current	1A Resistive load at rated voltage
Resistance	≤ 0.05Ω - on state
Isolation Resistance	$>10^{10}$ Ω - off state
Arc Protection	No
Update Rate	1 ms

User 24V Output Details

Grid-Tie Inverter User 24V Output **A supply provided for powering external equipment or for providing power to digital inputs.**	
Terminal 09 on the auxiliary I/O connector	
Output Voltage	≥18V, ≤ 26V
Maximum Output Current	≥160mA Note: the maximum output current is the sum of all 24V sourced outputs, i.e. $i_{DINOUT1} + i_{DINOUT2} + i_{24V\ USER} \leq 160mA$
Overload/Short Circuit Protection	Indefinite

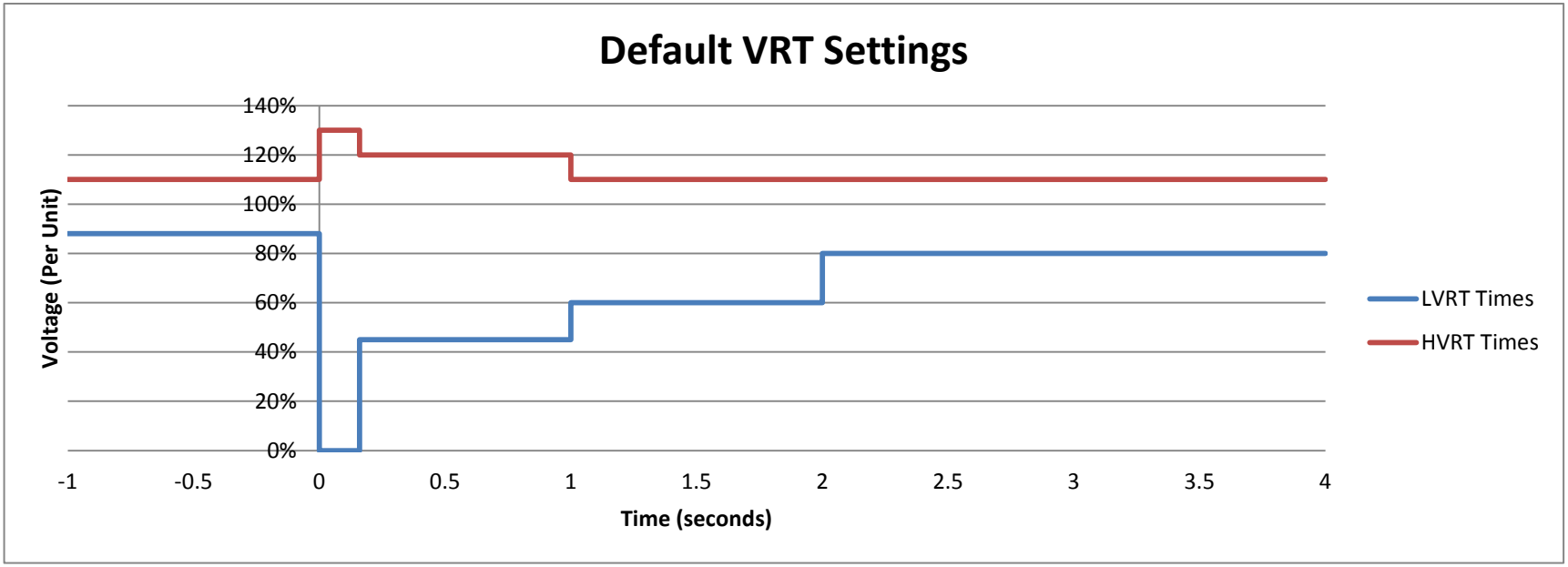
Earthing/Safety Details

Earthing/Safety Details	
Earthing	**Each unit must be permanently earthed according to EN 61800-5.** For permanent earthing, EN 61800-5 states that: *A cross-section conductor of at least 10mm² for copper or 16mm² aluminium is required.* Use a copper protective earth conductor of at least 10mm² minimum cross-section. **Conductors must be sized in accordance with Local Wiring Regulations which always take precedence.** As a guide, refer to the Input Current for the drive given in the Electrical Ratings tables.
Input Supply Details (TN) and (IT)	Drives without filters are suitable for earth referenced (TN) or non-earth referenced (IT) supplies. External filters are available for use on earth referenced (TN) supplies only.
Earth Leakage Current	>>100mA (all models)

Grid Responses

HVRT and LVRT

As shipped, the 890GTR complies with UL1741/IEEE1547 requirements for Voltage Ride Through. The following graph shows the pre-programmed trip times for the 890GTR. The space between the red and blue lines is the ride through area:



The 890GTR can also be programmed to withstand HVRT and LVRT magnitude limits and times that meet or exceed the requirements listed shown above. Programming of the thresholds should only be performed by trained maintenance or service personnel. Voltage trip set points are settable in the range of 0 to 130% per unit. Individual trip time durations for each trip level is settable from 0.1 seconds up to 100 seconds. For needs outside of these capabilities, consult the factory.

NOTE: Standard trip limit voltage accuracy is +/- 14.4Vrms, standard trip time limit accuracy is +/- 30msecs.

FqRT

The 890GTR can maintain grid connection through grid frequency shifts that exceed the requirements of WECC and PRC-024-1. The 890GTR comes pre-programmed to meet the requirements of IEEE 1547 and UL1741. The frequency trip points are:

- Frequency > 62, disconnection after .16 seconds
- Frequency > 60.5 Hz, disconnection after 0.2 seconds
- Frequency < 57.0 Hz, disconnection after 0.16 seconds
- Frequency < 59.5Hz, disconnection after 2 seconds

The above settings and parameters are factory adjustable to meet local grid fault codes, application demands, and 50Hz installations. Under frequency trip setpoints are adjustable from 40Hz to 60Hz. Over frequency trip setpoints are adjustable from 50Hz to 75Hz. Trip times are also adjustable from 0 seconds to 300 seconds.

NOTE: Standard trip limit frequency accuracy is +/- 0.1Hz, standard trip time limit accuracy is +/- 30msecs.

Changing Voltage and Frequency Fault Trip Levels and Times

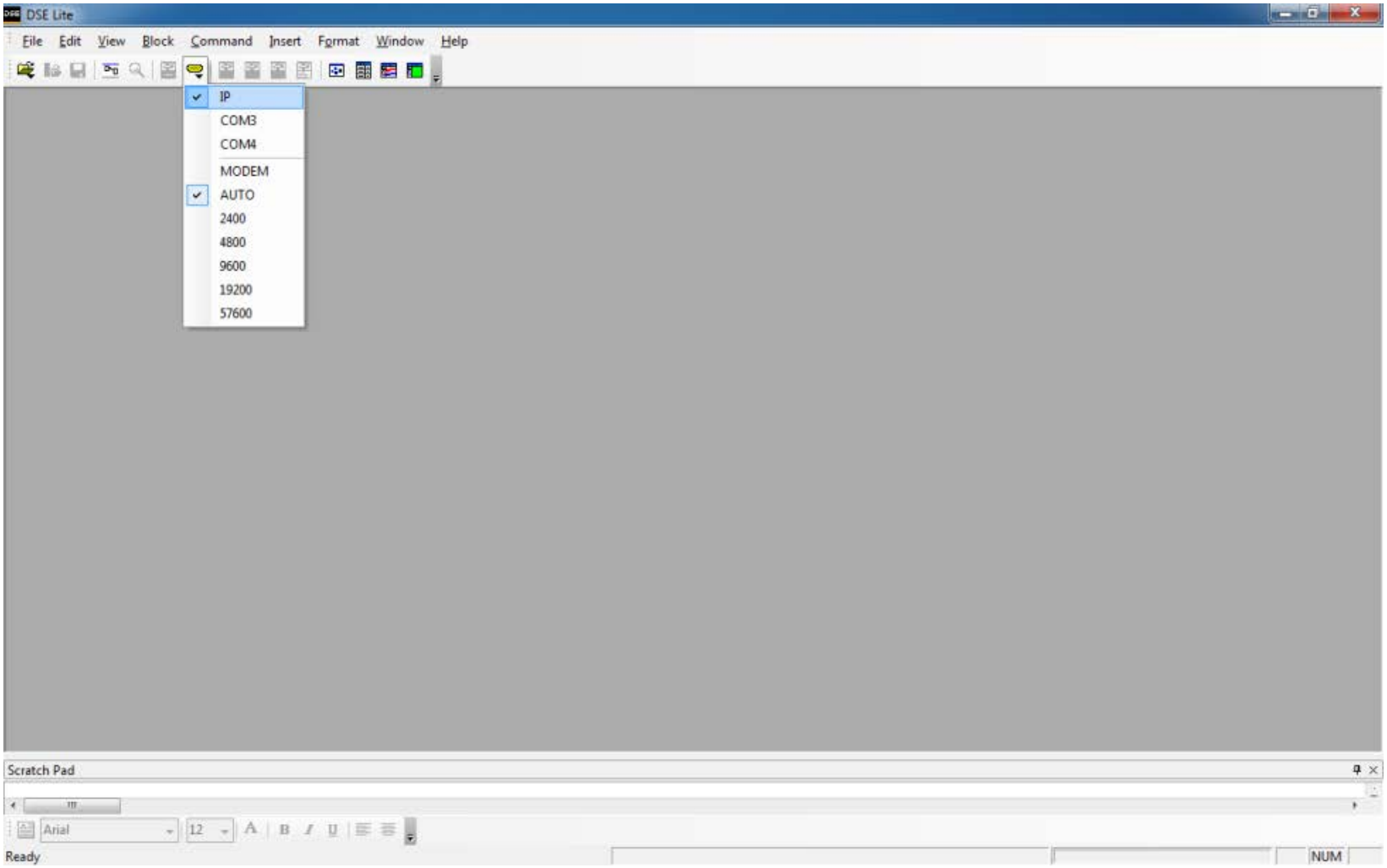
WARNING: Only trained personnel should attempt to adjust grid fault response characteristics. Incorrect settings may result in personnel hazards due to prolonged energized island conditions caused by the 890GTR inverter.

WARNING: Do not attempt to adjust the fault levels or trip times while the inverter is operating.

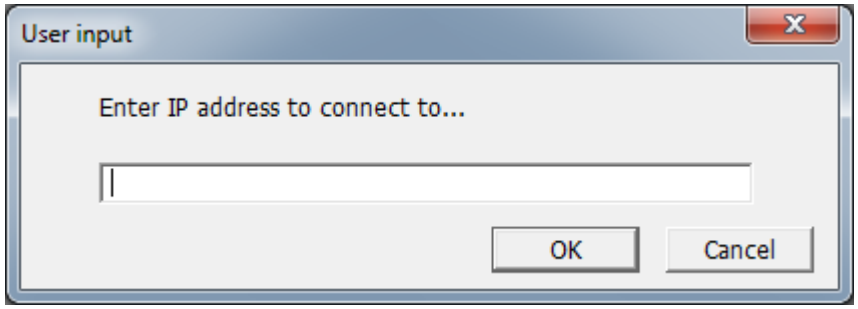
Adjustments to the Voltage and Frequency Fault Tip Levels and Times can be made through the DSE Lite tool that is included with the shipping memory stick, is installed on the equipped touchscreen, and is available through download from our website or by contacting Parker EGT customer service.

To access the 890GTR configuration, first ensure the inverter is not synchronized to the Grid and that the AC and DC main power disconnect devices are in the open state. Open DSE Lite on your computer in Wizard mode. Consult the factory on how to get access to Wizard mode functionality. Next connect to the inverter through the DSE tool which can be accomplished 1 of 2 ways.

1. Connect via Network. If you're communicating to the 890GTR via Modbus TCP or Ethernet IP, either plug into a network access point that has access to the 890GTR or connect your computer directly to the Ethernet port on the 890GTR device. In DSE, select the Comm Port Icon as shown below:



2. Next, enter the IP address of the 890GTR module in the pop-up text field:



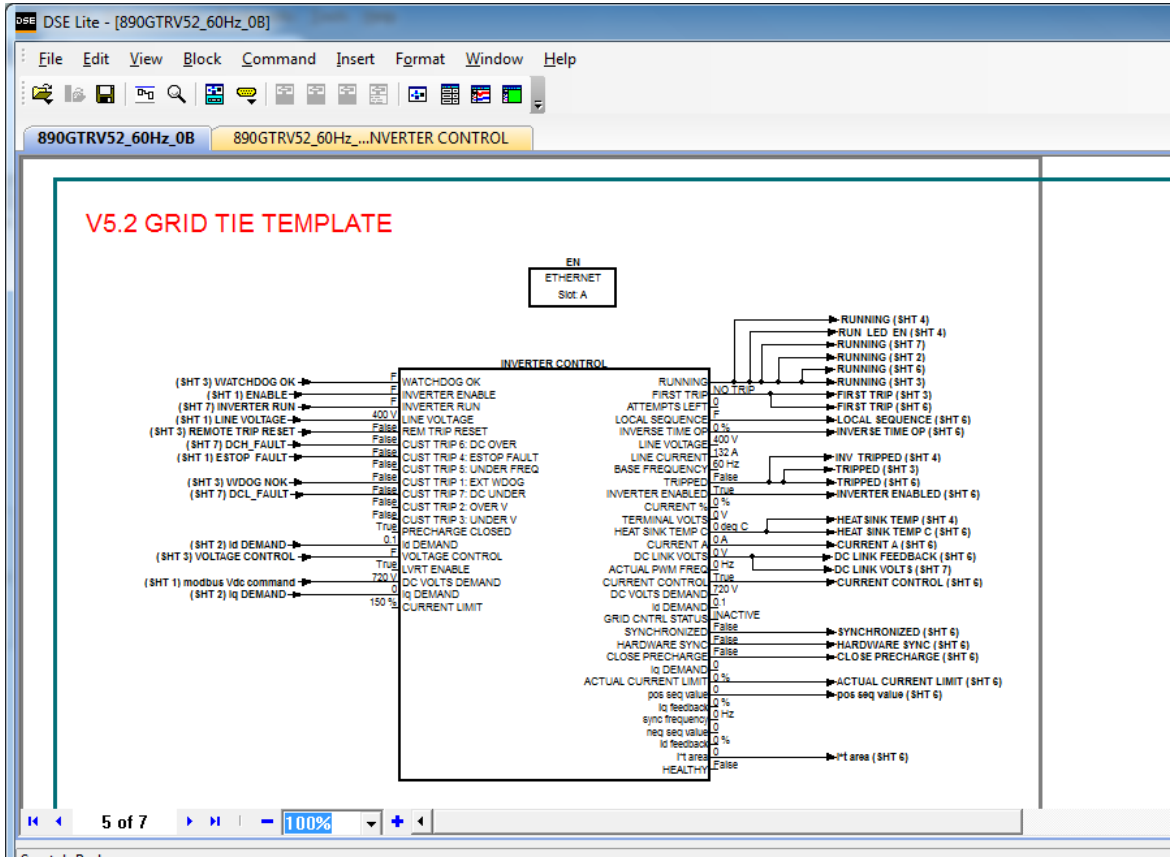
In the scratchpad at the bottom of the screen, it should say that DSE is now connected to the 890GTR at the IP address you just entered.

3. The other option available to connect to the 890GTR is to plug your computer directly into the 890GTR programming port. After the DC and AC main power disconnect devices have been opened and all energy has been removed from the DC bus of the inverter, connect your computer to the programming port on the front of the inverter. In DSE select the Comm Port Icon and select the correct COM port that aligns with the port that is physically connected to the PCM. In the Scratch Pad section at the bottom of your DSE lite screen, it should say the inverter is now connected via the COM port.

Once you have successfully connected to the 890GTR, the following steps are the same for both connection methods.

1. Press F9 or go to File->Open On-Line to retrieve the existing configuration from the inverter.

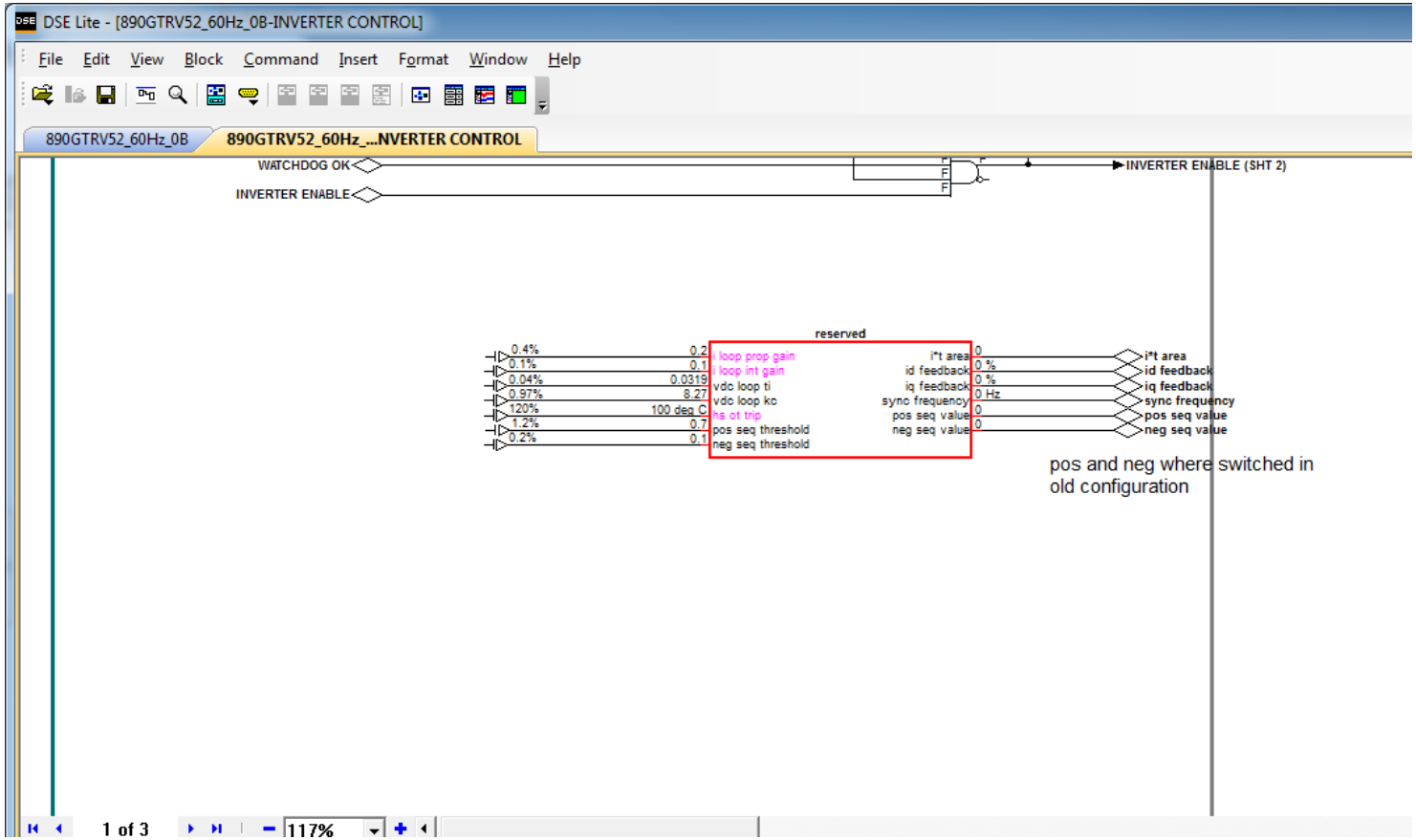
2. Scroll to page 5 of the configuration to find the **Inverter Control** Function block using the Page Up and Page Down keys, or by clicking the Next Page Keys at the bottom of the screen.



3. Double Click on the **Inverter Control** Function Block to access the parameters within the Block.

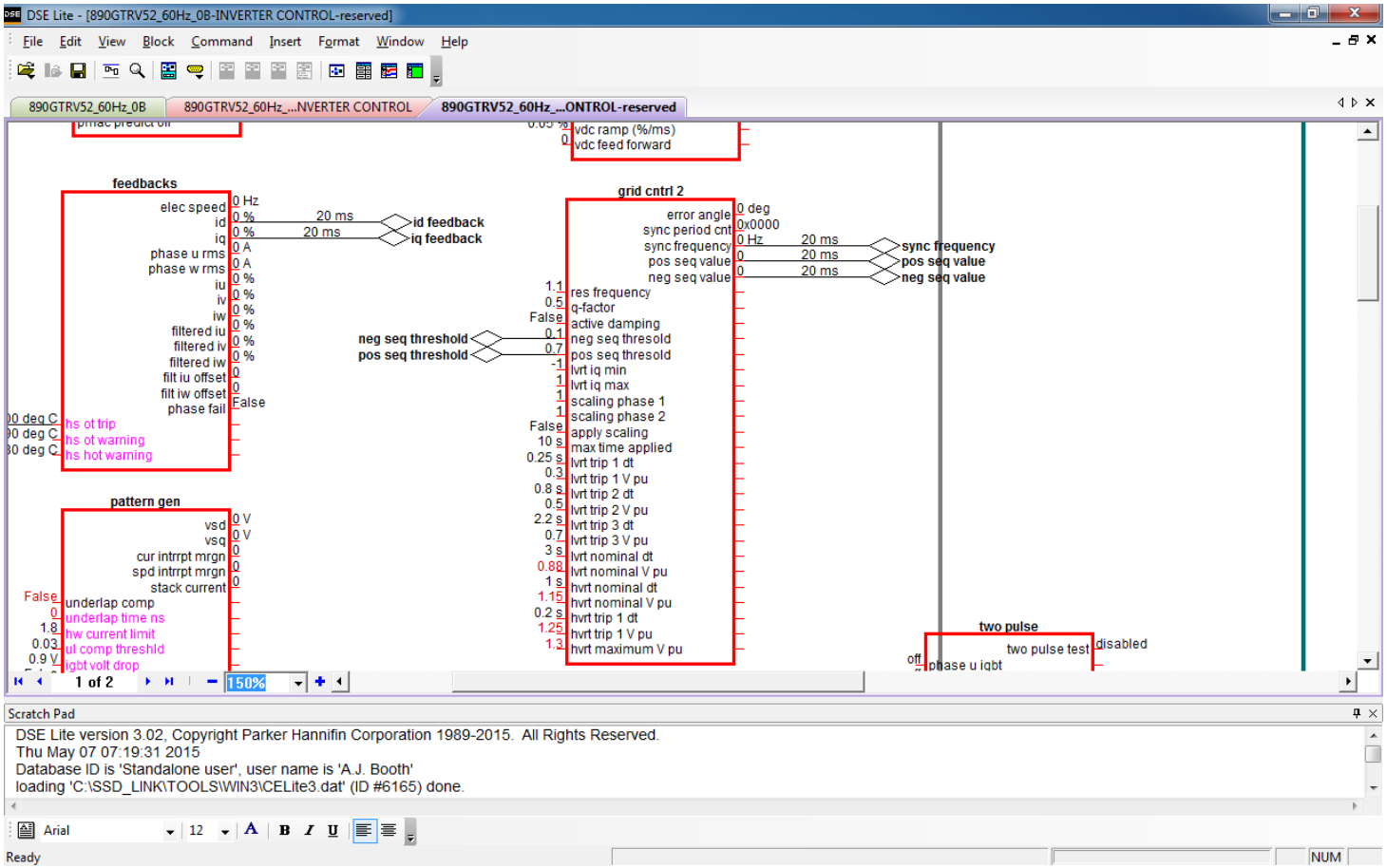
4. A new window within DSE should have opened called **Inverter Control**. Within that window, scroll to page 1 of the configuration where you should find a red square block titled “reserved.”

5. Double Click on the “reserved” function block to access the parameters within the block.

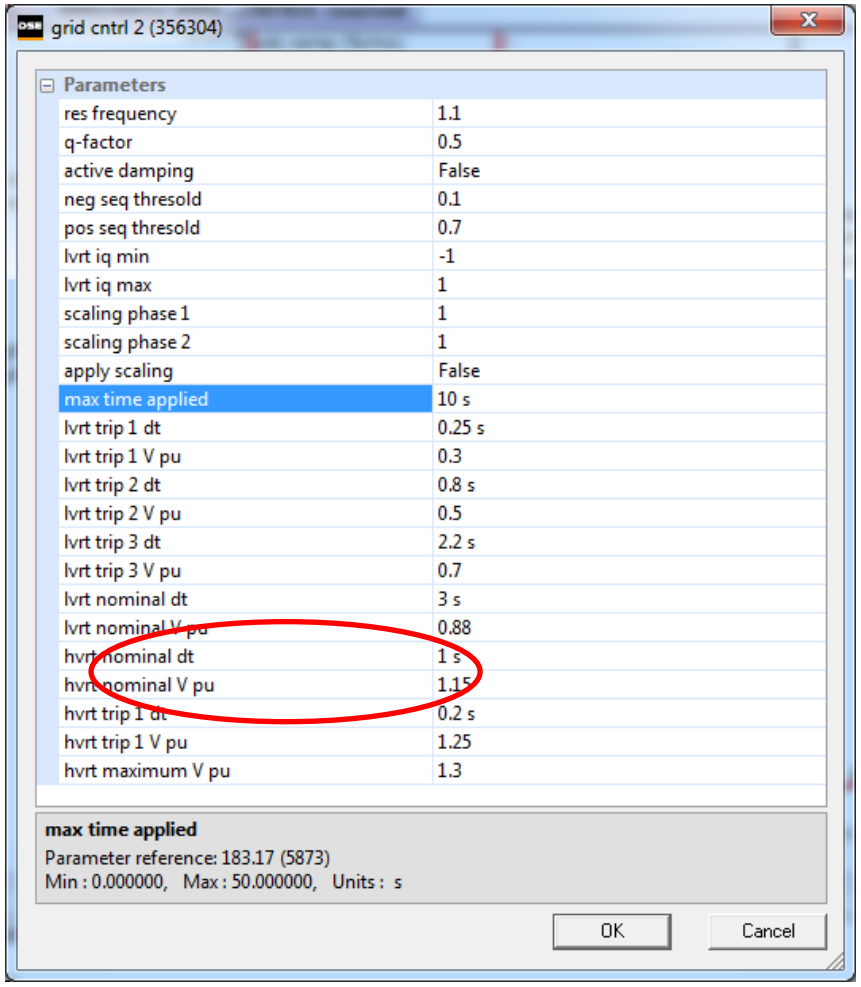


6. A new window should have opened allowing access to the **Inverter Control –reserved** block items.

7. To change voltage fault response times and values, from within the reserved window scroll through the pages until you find the grid cntrl 2 function block shown below:



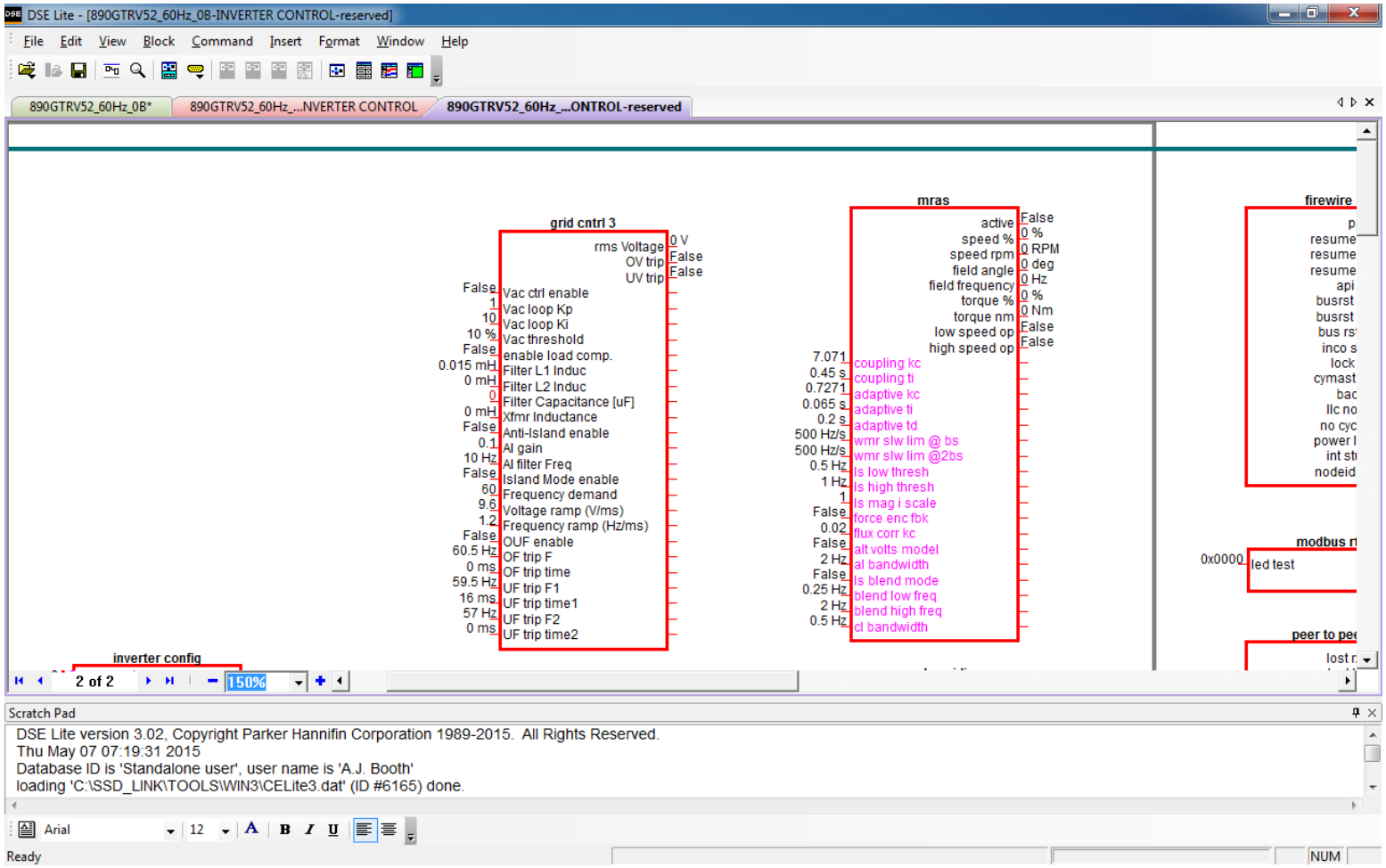
8. Double Click on the grid cntrl 2 block to enable edit access to the full parameter list shown below:


grid cntrl 2 (356304)
Parameters
res frequency 1.1
q-factor 0.5
active damping False
neg seq thresold 0.1
pos seq thresold 0.7
lvrt iq min -1
lvrt iq max 1
scaling phase 1 1
scaling phase 2 1
apply scaling False
max time applied 10 s
lvrt trip 1 dt 0.25 s
lvrt trip 1 V pu 0.3
lvrt trip 2 dt 0.8 s
lvrt trip 2 V pu 0.5
lvrt trip 3 dt 2.2 s
lvrt trip 3 V pu 0.7
lvrt nominal dt 3 s
lvrt nominal V pu 0.88
hvrt nominal dt 1 s
hvrt nominal V pu 1.15
hvrt trip 1 dt 0.2 s
hvrt trip 1 V pu 1.25
hvrt maximum V pu 1.3
max time applied
Parameter reference: 183.17 (5873)
Min : 0.000000, Max : 50.000000, Units : s
OK
Cancel

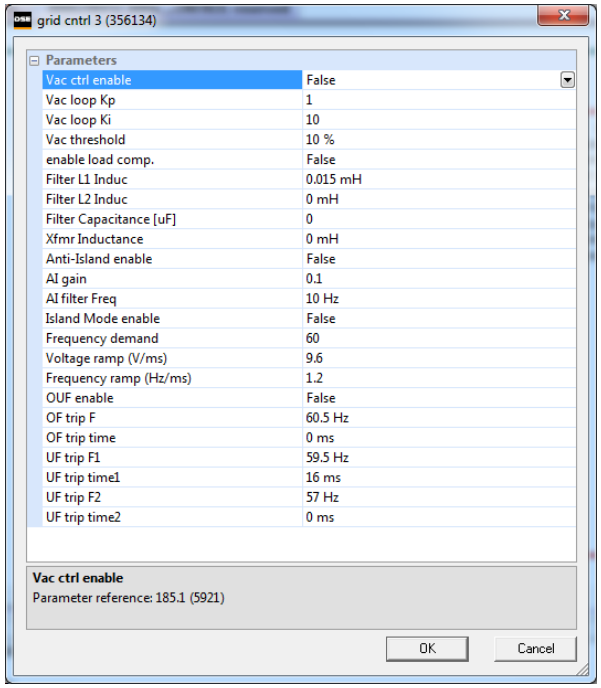
9. Adjust the LVRT and HVRT parameters to the desired values. The Voltages are in per unit terms and the times are in seconds. The Min and Max values for every parameter are noted at the bottom of the pop-up as shown above.

10. Click OK when finished.

11. To access the Frequency Trip value and time settings, from within the Same **reserved** function block window, scroll through the pages until you find the grid cntrl 3 block.



12. Double click on the block to access the parameter list editor pop-up:



13. Adjust the OF and UF (over frequency and under frequency) trip limits and times.

14. Click OK to store your results.

15. In the main window go to Command -> Parameter Save.

16. Your parameters should now be saved. Close DSE and disconnect your computer.

Synchronization to the Grid

The 890GTR initiates grid synchronization through several steps noted in Chapter 3. The final 2 steps involve the flowing of grid current in the following manner:

1. Closing the AC filter capacitor contactor – Closing of the contactor connects the internal AC filter capacitors to the grid. Since the capacitors have no voltage prior to the contactor closing, there is a current in-rush that takes place as the capacitors get charged up to the grid voltage. The amount of current will vary based on several factors like the installation site layout and grid impedance but may be as high as 90A peak to peak. This current will subside within a few 50Hz or 60Hz power cycles to a nominal VAR current level based on the grid voltage and model number ordered.
2. Synchronizing to the grid – When the inverter synchronizes to the grid it begins firing its internal semiconductor devices to achieve the required output power or current. During the initial synchronization period, the internal controllers may produce up to 30A peak to peak before they adjust to the correct user commanded output value.

Transformer Harmonics

- Nominal frequency = 60/50 Hz
- Fundamental primary current = 128 Arms
- Current present from inner-harmonics have been included into the closest harmonic
- The following table does not include the effects of distortion of the supply network due to other loads and non-linear effects of the network

Nominal impedance = 5.75% p.u.; +/-7.5%

Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)	Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)
60	1	130.9	100.0	50	1	131.4	100.0
120	2	0.4	0.3	100	2	0.4	0.3
180	3	0.3	0.2	150	3	0.4	0.3
240	4	0.2	0.1	200	4	0.2	0.1
300	5	0.9	0.7	250	5	0.5	0.4
360	6	0.1	0.0	300	6	0.2	0.1
420	7	0.5	0.4	350	7	0.5	0.4
480	8	0.0	0.0	400	8	0.1	0.0
540	9	0.2	0.2	450	9	0.1	0.0
600	10	0.1	0.0	500	10	0.1	0.1
660	11	0.4	0.3	550	11	0.1	0.1
720	12	0.0	0.0	600	12	0.1	0.1
780	13	0.2	0.1	650	13	0.2	0.1
840	14	0.1	0.1	700	14	0.1	0.0
900	15	0.2	0.1	750	15	0.1	0.1
960	16	0.0	0.0	800	16	0.1	0.0
1020	17	0.3	0.3	850	17	0.1	0.1

Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)	Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)
1080	18	0.0	0.0	900	18	0.1	0.0
1140	19	0.2	0.2	950	19	0.1	0.1
1200	20	0.0	0.0	1000	20	0.1	0.1
1260	21	0.1	0.1	1050	21	0.1	0.1
1320	22	0.1	0.1	1100	22	0.1	0.1
1380	23	0.1	0.1	1150	23	0.2	0.1
1440	24	0.1	0.0	1200	24	0.1	0.1
1500	25	0.1	0.1	1250	25	0.2	0.1
1560	26	0.1	0.1	1300	26	0.1	0.0
1620	27	0.3	0.2	1350	27	0.0	0.0
1680	28	0.3	0.2	1400	28	0.1	0.1
1740	29	1.3	1.0	1450	29	0.3	0.2
1800	30	0.1	0.1	1500	30	0.1	0.1
1860	31	0.2	0.2	1550	31	0.5	0.4
1920	32	0.1	0.1	1600	32	0.1	0.1
1980	33	0.0	0.0	1650	33	0.1	0.1
2040	34	0.0	0.0	1700	34	1.6	1.2
2100	35	0.1	0.1	1750	35	1.3	1.0
2160	36	0.0	0.0	1800	36	0.0	0.0
2220	37	0.1	0.0	1850	37	0.3	0.2
2280	38	0.0	0.0	1900	38	0.1	0.0
2340	39	0.0	0.0	1950	39	0.0	0.0
2400	40	0.0	0.0	2000	40	0.1	0.1
2460	41	0.0	0.0	2050	41	0.1	0.1
2520	42	0.0	0.0	2100	42	0.0	0.0
2580	43	0.0	0.0	2150	43	0.0	0.0
2640	44	0.0	0.0	2200	44	0.0	0.0
2700	45	0.0	0.0	2250	45	0.0	0.0

Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)		Frequency (Hz)	harmonic order	Magnitude (Arms)	THD (%)
2760	46	0.0	0.0		2300	46	0.0	0.0
2820	47	0.0	0.0		2350	47	0.0	0.0
2880	48	0.0	0.0		2400	48	0.1	0.0
2940	49	0.0	0.0		2450	49	0.0	0.0
3000	50	0.0	0.0		2500	50	0.0	0.0

Connector Torque Requirements

Bolt Size	Torque (NM)							
	Steel 6/6		**Steel 8/8**		Steel 4/6		Brass 20T UTS	
	Installation	Inspection	Installation	Inspection	Installation	Inspection	Installation	Inspection
M4	1.9	1.69	**3.5**	**3.0**	**1.3**	**1.1**	**1.8**	**1.5**
8-32	2.2	1.9	**3.8**	**3.2**	**1.5**	**1.3**	**-**	**-**
10-32	3.2	2.7	**5.4**	**4.6**	**2.1**	**1.8**	**-**	**-**
M5	4.0	3.4	**7.1**	**6.0**	**2.7**	**2.3**	**3.6**	**3.1**
M6	6.8	5.8	**11.5**	**9.7**	**4.5**	**3.8**	**5.4**	**4.6**
1/4-20	7.6	6.5	**13.0**	**11.1**	**5.1**	**4.3**	**-**	**-**
5/16-18	15.7	13.3	**26.7**	**22.7**	**10.4**	**8.8**	**-**	**-**
M8	16.5	14.0	**28.0**	**24.3**	**11.0**	**9.4**	**12.3**	**10.4**
3/8-18	27.9	23.7	**47.5**	**40.4**	**18.6**	**15.8**	**-**	**-**
M10	32.8	27.9	**55.0**	**47.5**	**21.8**	**18.5**	**23.7**	**20.2**
M12	91.0	77.4	**155.1**	**130.2**	**60.6**	**51.5**	**66.0**	**56.1**
1/2-12	68.0	57.8	**115.8**	**98.4**	**45.3**	**38.5**	**-**	**-**
M16	142.0	120.7	**241.0**	**208.8**	**95.0**	**80.8**	**101.0**	**85.9**
M20	277.0	235.5	**465.1**	**396.0**	**185.0**	**157.3**	**205.0**	**174.3**

Use the above torques for 6/6 screws for all busbar connections and general use unless the screw material requires lower torque.
Use the torques for 8/8 screws only where specified (These torques are generally used for very high loads).

Appendix F List of Fault Codes

Inverter Fault List

STATE	FAULT NAME	MEANING	Possible Reason for Trip
0	**OK**		
1	**OVERVOLTAGE**	The Inverter internal DC link voltage is too high.	The supply voltage is too high. Failure to synchronize properly to the line
2	**UNDERVOLTAGE**	The Inverter internal DC link voltage is too low.	The supply voltage is too low. The supply voltage is missing. Grid cables too long. Possible maintenance required.
3	**OVERCURRENT**	The output current being drawn from the Inverter is too high.	Short circuit of the output. Excessive line disturbance. Possible maintenance required.
4	**HEATSINK**	The inverter heatsink is too hot.	Excessive ambient temperature. Cooling fan failure. Module assembly defect--maintenance required.
17	**MOTOR OVERTEMP**	Filter inductor temperature is too high.	Excessive load. Prolonged operation without forced cooling (check cooling fan health) Check setting of INVERT THERMIST parameter in I/O TRIPS menu. Break in filter inductor thermostat wire or defective thermostat.
24	**DESAT OVER I**	Abnormally high voltage drop across IGBT(s) due to excessive current within IGBT module	Short circuit of the output. Excessive line disturbance. Possible maintenance required.
25	**VDC RIPPLE**	Excessive DC link ripple	Defective DC supply. Poor DC supply connection.

F-2 List of Fault Codes

STATE	FAULT NAME	MEANING	Possible Reason for Trip
41	**STACK TRIP**	The inverter was unable to distinguish between an overcurrent/desat or overvoltage trip	Short circuit of the output. Excessive line disturbance. Possible maintenance required.
52	**FIRMWARE ERROR**	The firmware in the inverter has stopped executing	Corrupted firmware. Re-install firmware. Replace module.
63	**DRIVE CONFIG**	Missing or corrupted configuration.	Re-load configuration.
65	**CUSTOM TRIP 1 (EXERNAL WATCHDOG TIMEOUT)**	Communication over Ethernet TCP (modbus) has been lost or is not being updated.	Verify Modbus connection and ensure watchdog is serviced at least three times per second.
68	**CUSTOM TRIP 4 (ESTOP)**	External Estop circuit is not energized.	Verify 24 Volts DC is supplied to Estop (EPO) circuit.
70	**CUSTOM TRIP 6 (DC OVERVOLTAGE)**	DC bus voltage is above 840 volts dc while inverter is running.	Check health of DC supply.
71	**CUSTOM TRIP 7 (DC UNDERVOLTAGE)**	DC bus voltage is below 580 volts dc while inverter is running.	Check health of DC supply and connections.
90	**VOLTAGE MAINS LOST**	Positive and/or negative sequence values out of range.	Check health of grid connection. Adjust trip values if needed.
91	**HIGH VOLTAGE TRIP**	Grid voltage too high.	Check health of grid connection. Adjust trip values in Grid Control 2 block if needed.
92	**LOW VOLTAGE TRIP**	Grid voltage too low.	Check health of grid connection. Adjust trip values in Grid Control 2 block if needed.
93	**OVER FREQUENCY**	Grid frequency too high.	Check health of grid connection. Adjust trip values in Grid Control 3 block if needed.
94	**UNDER FREQUENCY**	Grid frequency too low.	Check health of grid connection. Adjust trip values in Grid Control 3 block if needed.
If any fault is presented on Modbus other than those listed, Contact Parker EGT Product Support			

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